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Environmental Assessment

Arrowhawk Fuels Reduction and Ecosystem Enhancement Project

Carson Ranger District, Humboldt-Toiyabe National Forest

Washoe County, Nevada

Jones Creek

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INTRODUCTION

Document Structure

The Forest Service has prepared this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) and the Healthy Forest Restoration Act (HFRA) and other relevant Federal and State laws and regulations. This Environmental Assessment discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into four parts:

- *Introduction:* The section includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.

- *Comparison of Alternatives, including the Proposed Action:* This section provides a more detailed description of the agency's proposed action as well as the No Action Alternative. Alternatives were developed based on significant issues raised by the public and other agencies. This discussion also includes possible mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.

- *Environmental Consequences:* This section describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource area. Within each section, the affected environment is described first, followed by the effects of the No Action Alternative that provides a baseline for evaluation and comparison of the other alternatives that follow.

- *Agencies and Persons Consulted:* This section provides a list of preparers and agencies consulted during the development of the environmental assessment.

- *Appendices:* The appendices provide more detailed information to support the analyses presented in the environmental assessment.

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Carson Ranger District Office in Carson City, Nevada.

Background

The Healthy Forest Restoration Act (HFRA) of 2003 was signed into law on December 3, 2003. The purpose of the HFRA is in part to: (A) reduce wildfire risk to communities, municipal water supplies, and other at-risk Federal land through a collaborative process of planning, prioritizing, and implementing hazardous fuel reduction projects; (B) enhance efforts to protect watersheds and address threats to forest and rangeland health, including

catastrophic wildfire, across the landscape and; (C) protect, restore, and enhance forest ecosystem components, promoting the recovery of threatened and endangered species to improve biological diversity and enhance productivity and carbon sequestration (HR 1904).

The Arrowhawk Fuels Reduction analysis was completed under the HFRA of 2003 (USDA/DOI 2004). Section 102 (a) of the HFRA authorizes hazardous fuels reduction projects on: (a) Federal land in wildland-urban interface areas or Federal lands in condition class three or condition class two within fire regimes I, II or III, in such proximity to a municipal water supply system or a stream feeding such a system within a municipal watershed that a significant risk exists that a fire disturbance event would have adverse effects on the water quality of the municipal water supply or the maintenance of the system, including a risk to water quality posed by erosion following such a fire disturbance event.

The project area is located southwest of Reno Nevada on the east side of Mount Rose (Figure 1). The elevation of the project area ranges from 5,100 to 8,000 feet. The legal description for the project area is Township 19N, Range 19E, sections 31 and 32; Township 18N, Range 19E, sections 4, 5, 6, 7, 9, 10, 15, 16, 21, 22, 27, 28, 29, 30, 32, 33 and 34; and Township 19N, Range 19E, sections 4, 5 and 9, Mount Diablo Meridian. Figure 1 is a vicinity map of the Arrowhawk Project Area. This project on National Forest lands would implement hazardous fuels reduction in locations identified as priorities in the Carson Range Multi-jurisdictional Fuel Reduction and Wildfire Prevention Strategy completed in 2008 in cooperation with 14 local and state land and fire management entities.

The analysis area is comprised of conifer, shrub, meadow and aspen areas. There are approximately 1,700 acres of conifer; 4,100 acres of shrub; 200 acres of aspen; the remainder is barren, herbaceous, willow, or urban. The conifer areas are primarily eastside pine, which includes Jeffrey and ponderosa pine and white fir. Shrub species primarily include bitterbrush and sagebrush, with interspersed fields of dense manzanita, ceanothus and mountain mahogany. Existing dense vegetative conditions with high fuel loading and abundant ladder fuels create a high potential of ecologically uncharacteristic and catastrophic wildland fires.

Ironically, fire suppression has been a major contributor to the development of these conditions and as well as historic land use and management practices. Due to the proximity of the project area to communities, fire suppression is expected to continue largely as it has been practiced in recent decades. However, large severe fires are becoming increasingly common. This type of fire behavior is considered uncharacteristic of the normal fire regime for the area which would typically consist of many low intensity fires that would tend to consume dead vegetation and thin the understory of young trees and shrubs. Due to the removal of the low intensity fires, which are easily and successfully suppressed, only fires burning under extremely severe conditions currently have a role in this landscape. These fires have severe effects on ecological and watershed values as well as posing threats to communities. Examples of these effects can be seen as a result of the Hawkin Fire in 2007, which occurred on the northern end of the project area. Other recent examples fires burning under severe fire conditions include the Caughlin Fire of 2011, which burned into the project area from the adjacent private property and the Washoe Lane Fire in January of 2012, which burned into the Galena southeast of the project area.

Purpose and Need for Action

The purpose of this initiative is to:

- Reduce fire hazard to the communities of Arrow Creek, Caughlin Ranch along the Mt. Rose highway, the residences within Logan Meadows, as well as other residences adjacent to the forest boundary in the general area of southwest Reno.
- Provide defensible areas for firefighters to control and/or suppress future wildland fires.
- Improve watershed conditions and protect municipal watersheds from adverse effects of severe wildland fire on soil and water quality.
- Reduce dense vegetation to increase vigor, health and growth rates in the forested ecosystem.
- Improve aspen stands where health of the stand is declining from competition from encroaching conifer trees.

This action is needed because tree and shrub densities in the project area are increasing and vegetation health and vigor is declining. This is causing competition for water, and sunlight. The existing vegetation conditions support fire intensity levels which threaten the safety of firefighters engaged in community protection efforts. In addition, decreased vegetation vigor is increasing the potential for the spread of insect, disease and wildfire in the forest.

There is an increase in the number of conifers in aspen stands. As a result the aspen stands in the analysis area are slowly being outcompeted by conifers and the stands are declining in size. Healthy aspen stands contribute to the long-term forest health and are an important component of a functioning ecosystem (material cycling, succession, habitat, etc.). Many wildlife species utilize aspen stands to some degree and some species depend on them.

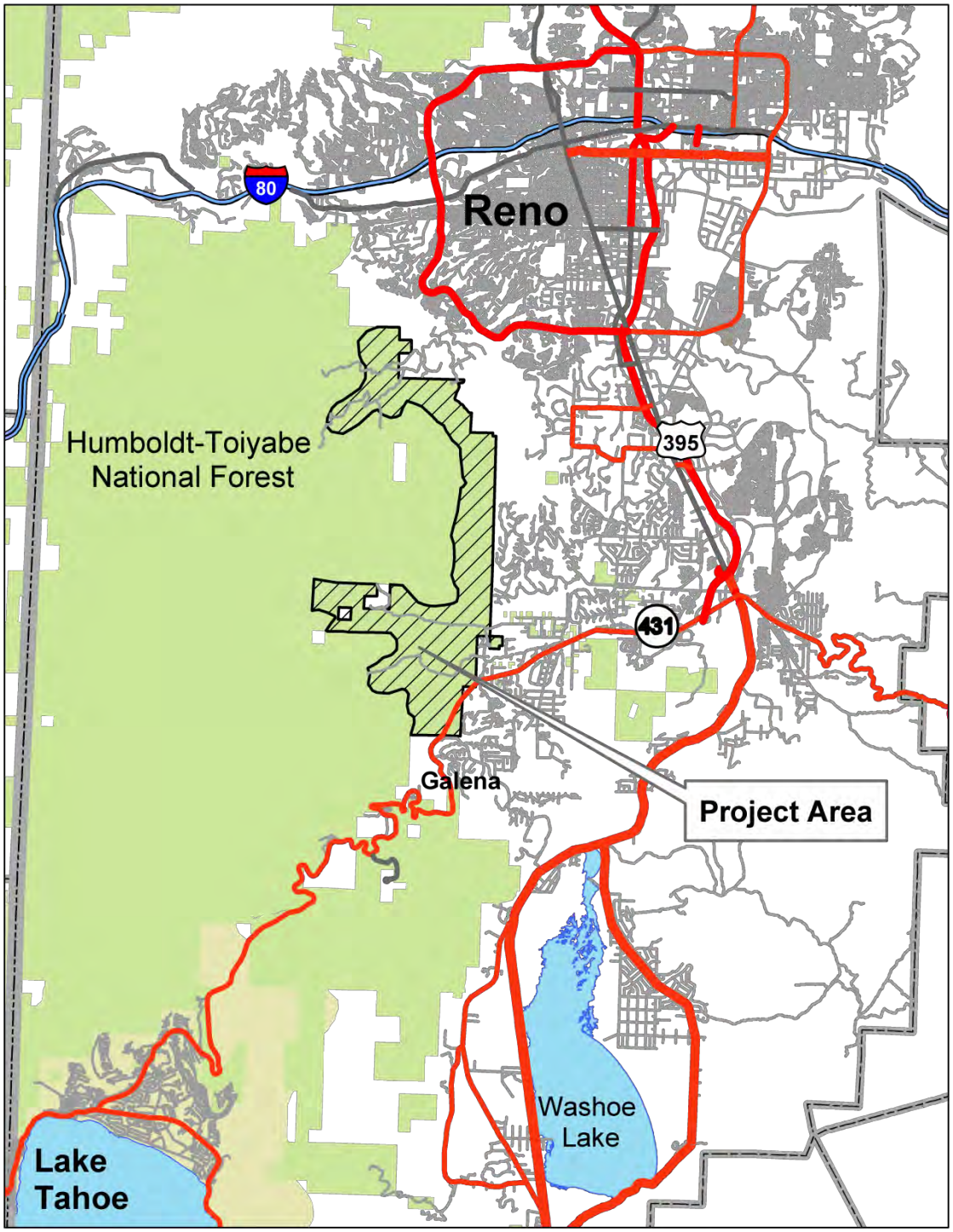
Management Direction

The Arrowhawk Fuels Reduction Project is proposed at this time to respond to goals and objectives of the National Fire Plan (USDA/DOI 2000) and the Toiyabe National Forest Land and Resource Management Plan (USDA 1986), as amended by the Sierra Nevada Forest Plan Amendment (USDA 2004) and helps move the project area towards desired conditions described in these plans. In order to eliminate repetitive discussion and documentation, this environmental assessment tiers to the Toiyabe National Forest Land and Resource Management Plan (USDA 1986), as amended by the Sierra Nevada Forest Plan Amendment (USDA 2004). Specialist reports were also prepared for this analysis and are incorporated by reference.

The project area is located within Management Area #2 – Carson Front, as identified in the Toiyabe National Forest Land and Resource Management Plan (USDA 1986). Land allocations from the Sierra Nevada Forest Plan Amendment (SNFPA) (USDA 2004) within the project area include WUI defense and threat zones, general forest and riparian conservation areas (RCA). Figure 3 depicts the WUI defense and threat zones. Land allocations from the Sierra Nevada Forest Plan Amendment (SNFPA) (USDA 2004)

indicates most of the project area, approximately 98%, is located within the threat and defense zones of the wildland urban interface (WUI).

Figure 1 Project Vicinity Map



Proposed Action

The proposed action is being designed to reduce the hazard of a severe wildland fire by reducing forest fuel loading through treating vegetation in the three fuel layers: crown or canopy fuels, ladder fuels, and surface fuels.

By products of this proposed action would also:

- Improve tree vigor and plantation tree growth and survival;
- Improve and protect wildlife habitat;
- Protect and improve watershed conditions by decreasing the threat of high severity wildfire and;
- Enhancement and expansion of existing aspen stands.

Treatments would be spaced throughout a ten year time period. Some areas would receive more than one treatment, such as thinning followed by underburning, etc. Figure 2 is a map indicating the treatments under the proposed action.

Decision Framework

Given the purpose and need, the deciding official reviews the proposed action and environmental analysis in order to make the following decisions:

1) Whether to approve the proposed Arrowhawk Fuels Reduction and Ecosystem Enhancement Project as written or with modifications.
2) Whether or not the project has the potential for significant impacts and if an environmental impact statement would need to be prepared prior to issuance of any decision.

Public Involvement

The Forest Service used multiple methods to develop the proposed action and determine the major issues of this project. The Forest Service involved members of the public, interested private groups, and State and local agencies, including:

- Listing of the project in the Schedule of Proposed Actions (SOPA), published quarterly by the Humboldt-Toiyabe National Forest, 2009-present.
- Collaboration with the Nevada Fire Safe Council, and Sierra Fire Protection District.
- Publication of an opportunity to comment/scoping legal notice in the Reno Gazette Journal on August 21, 2009.
- Holding a public meeting in South Reno, Nevada on September 8, 2009
- Mailing the opportunity to comment/scoping document to 82 interested individuals and groups and adjacent landowners on August 17, 2009. Eight individuals provided comments during the scoping period.

Issues

Through the scoping process, the public and other agencies identified concerns in response to the Proposed Action. Identification of issues included reviews of written and verbal comments, input from Forest Service resource specialists, review of the Forest Plan, and comments from state, federal agencies and tribal governments. Comments identified during scoping were evaluated against the following criteria to determine whether or not the concern would be a major factor in the analysis process.

- Has the concern been addressed in a previous site-specific analysis, such as in a previous Environmental Impact Statement or through legislative action?
- Is the concern relevant to and within the scope of the decision being made and does it pertain directly to the Proposed Action?
- Can the concern be resolved through design criteria (avoiding, minimizing, rectifying, reducing or eliminating, or compensating for the proposed impact)?

Although a number of concerns and potential issues were noted during scoping and the analysis, no unresolved resource conflicts were identified. As documented in the Environmental Consequences section and this project's planning record, the Proposed Action would not result in unacceptable impacts on any given resource and the Proposed Action would not be inconsistent with applicable laws, regulations, rules, and Forest Plan standards and guidelines.

All comments, and issues raised during the various scoping periods have been addressed and those documents have been included in the project record.

ALTERNATIVES

This chapter describes the alternatives developed by the interdisciplinary team in response to the issues identified.

The team followed the alternative analysis and development procedures found under Section 104 of the HFRA. Section 104 (c) Consideration of Alternatives requires (A) the proposed agency action alternative; (B) the alternative of no action; and (C) an additional action alternative, if the additional alternative is proposed during scoping of the collaborative process and meets the purpose and need of the project, in accordance with regulations promulgated by the Council on Environmental Quality (CEQ). No additional alternatives were proposed during scoping, the no action and action alternatives are described below. Refer to chapter 3 for potential environmental effects of the alternatives.

No Action Alternative

Under the No Action alternative, current management plans would continue to guide management of the project area. No vegetation treatments would be implemented to accomplish project goals.

Proposed Action Alternative

This alternative satisfies the non-commercial funding alternative required by the November 3, 2009 Remedy Ruling by Judge England regarding the 2004 Framework (Sierra Nevada Forest Plan Amendment). The proposed action meets the requirements of a noncommercial funding alternative because only trees needed to meet fuels reduction or forest health improvement would be removed. Although trees of commercial value may be sold, no additional timber harvest of larger diameter trees would be included to create a break-even or positive economic return.

The proposed action (Figure 2) has been designed to reduce the hazard of a severe wildland fire by reducing forest fuel loading through treating vegetation in the three fuel layers: crown or canopy fuels, ladder fuels, and surface fuels.

Implementation of the proposed action is also expected to:

- Improve tree vigor and plantation tree growth and survival;
- Improve wildlife habitat;
- Protect and improve watershed conditions by decreasing the threat of high severity wildfire and;
- Enhancement and expansion of existing aspen stands.

Treatments would be spaced throughout a ten year time period. Some areas would receive more than one treatment, such as thinning and underburning. The Forest Service proposes to meet the purpose and need within the Arrowhawk Project area by implementing the following activities:

Shrub and Incidental Small Tree Thinning (Brush Units)

Within approximately 2,500 acres designated as brush treatment units, shrubs and small trees would be treated through mechanical means such as mastication, mowing, chainsaw cutting, chipping, piling and/or prescribed fire. The entire area within the units would not be treated if a partial treatment is sufficient to adequately reduce potential fire behavior or cannot be treated without severely impacting site stability. Generally, the treatments would focus on thinning the understory vegetation that acts as ladder fuels under larger individuals of both tree and brush species. Additionally, large expanses of continuous dense brush would be broken up by treatments.

The objective for treatments is to reduce fuel continuity by creating mosaics of different age classes of vegetation mimicking the natural vegetative patterns created by low intensity fire. The treatments would reduce dense concentration of shrubs and small trees under larger trees and break up the horizontal continuity of brushy fuels by creating mosaics of different age classes through treating 30 to 70 percent of the area per entry. The percentage treated would be based on fuel conditions, threat to property and resources from wildfire, and potential for invasive weeds.

For example, if the site has a high potential for cheatgrass invasion due to harsh site conditions such as southerly slope, poor soil, or lack of shade from over story vegetation the greater percentage of the existing vegetation may be retained per entry. Or if the site is adjacent to private property and the vegetation on site poses a significant threat, a percentage of vegetation from the higher end of the range would be removed. Entries would be generally be separated by 5 to 10 years in the WUI Defense Zone and 10 to 20 in the threat zone, but vegetative response would determine the actual timing for the next treatment cycle.

Healthy shrubs of larger size would be maintained to provide visual and habitat diversity and some snags of brushy species would also be retained. Bitterbrush and mountain mahogany would be favored for retention. If cheatgrass or other invasive are present in sufficient densities weed treatments may be completed prior to brush treatments. If conditions allow prescribed burning may occur following the initial mechanical treatments.

Trees in these units are generally scattered throughout the landscape or clustered in small groves rather than continuous stands. Thinning shrubs and small trees from beneath larger trees would be done to break the fuel ladder that allows fire to climb from surface into tree crowns. This would reduce the amount of heat generated in surface fires which can be lethal to trees even if their crowns do not burn. Initial treatments would focus on older age classes of shrubs showing evidence of moisture stress or age and density related decline.

The ridge top treatments would focus on the vegetation on the northern sides of the ridges which are areas in which fires would normally be expected to slow their rates of spread and intensity, and are areas where fire fighters often use to contain a fire. The width is based on potential fire behavior based on available fuels, weather and wind, and topography. These treatments are not designed to stop an oncoming wildfire by themselves, but rather to provide a safe location to facilitate fire suppression efforts and provide an anchor point for prescribed

burning projects. These units would be highest priority for treatment after Community Defense Zones.

On approximately 178 acres within the plantation areas, non-commercial size trees would be thinned to maintain an average of 16 to 20 foot spacing, off-site plantation trees would be removed, shrub densities around the trees would be reduced and pruning of live limbs up to six feet would occur.

Conifer Thinning

Treatments would occur on a total of approximately 878 acres; generally small diameter conifer trees up to 24” dbh would be thinned from below with fir species and insect and mistletoe infested trees favored for removal. This treatment would involve thinning from below by generally removing smaller trees that are most susceptible to wildfire and leaving the dominant largest trees that are less susceptible to fire. Trees would be thinned from below to 70 to 160 square feet of basal area with the average being approximately 90 square feet of basal area per acre. Small tree removal would be emphasized and trees less than 8” dbh would be thinned to 10 to 15 trees per acre. All trees 24” dbh or greater would be retained, additional trees would be retained within the basal area carrying capacity of the site. Residual trees would be irregularly spaced across the landscape with small groups of typically three to six closely spaced overstory trees to retain structural diversity. Removal of some trees greater than 24” dbh may be necessary for skid trails or landings. Residual basal areas, up to 250 square feet per acre, would be retained in some locations. These locations would include areas where high densities of trees greater than 24” dbh occur, in untreated areas, and in areas where pockets are retained, described in the paragraph below.

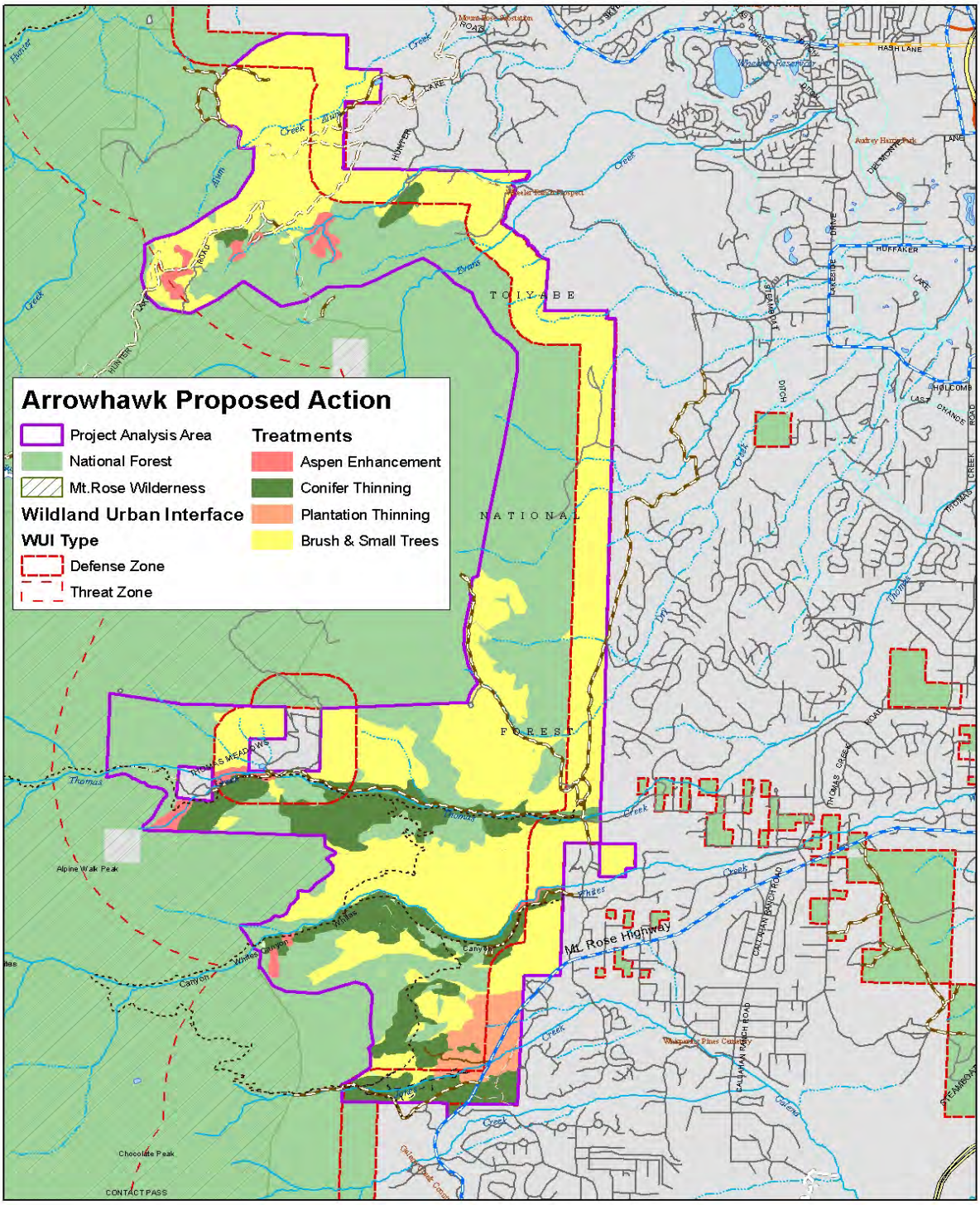
To provide habitat diversity pockets of trees, up to 1 ½ acres in size, would be retained in some of the riparian and other areas. These pocket zone areas include: a) within 200 feet North and 300 feet south of Thomas Creek from the WUI defense zone to Thomas Creek meadows, b) within 300 feet of Whites Creek from the trailhead west, c) within 300 feet of Jones Creek, and d) within units 4, 5 and 7. These tree pockets would occur in specified areas where canopy cover currently exceeds 50%, large down woody debris and larger diameter snags exist. The size of the tree pockets would vary and would be dependent on areas where specified conditions exist, however size would not exceed 1 ½ acres and pockets would be no closer than 300 feet to allow continuous forest cover to be broken up to deter the effects of fire. Some thinning of trees across diameter ranges less than 18” dbh may occur within these pockets; however canopy closure would not be reduced below 50 percent. Preferable over story trees include Jeffrey pine and aspen, though white fir over story as well as understory trees may be retained.

Within units 19 and 20, clumps of three to five trees at least 18” dbh and the existing understory trees in the clump would be retained. In this unit, outside the defense zone, one clump per acre would be retained, where the conditions exist. If possible, canopy closure within the entire unit would not be reduced below 40 percent, however if fuels reduction objectives cannot be met canopy closure would drop below 40 percent.

Conifer thinning units, and the units and zones where tree clumps and tree pockets may occur are displayed in figure 2. Additional trees within the pockets and in units 19 and 20 may be removed to allow for fire lines, skid trails and landings. Where these bisect pockets and in units 19 and 20, the canopy cover may be reduced below 40 or 50 percent.

On accessible slopes generally less than 30%, approximately 584 acres of conifer trees would be thinned and removed with ground based equipment such as tractors, mechanized equipment and pickup trucks through saw timber and commercial and personal use fuel wood contracts. On approximately 412 acres, on slopes generally greater than 30% and less accessible areas, trees would be removed with an aerial removal system, such as helicopter yarding. Whole tree yarding, removing the bole, tops and limbs of trees, would be utilized where economically feasible. In areas where whole tree yarding is not feasible, activity slash would either be lopped and scattered for under burning, or piled and burned or chipped. Treatment of activity slash would be a priority for prescribed burning. If adequate funding is not obtainable to do helicopter removal, treatments in those units would be completed on small trees and treated on site, through hand cutting and piling to burn or chip, or masticate. Funding would continue to be pursued to complete the forest health treatments, but fuels reduction is the priority as funding is available.

Figure 2: The Proposed Action



Animal Treatments

Carefully managed sheep grazing would be used to target areas infested with cheatgrass. Timing of grazing would occur when cheatgrass is most susceptible to damage and stress from defoliation. For cheatgrass, this includes short time periods in the spring and fall when the plant is in "green-up". Targeted grazing could occur on approximately 2,900 acres of currently infested sites. Grazing would not occur in aspen sites or other sensitive meadow and riparian zones. All known sites infested with medusa head would be avoided to reduce the potential to move medusa head seed to other portions of the project area.

Prescribed Fire

Prescribed fire would be applied throughout the project area as conditions allow. Burning would include burning slash piles produced in thinning brush and trees, broadcast burning of shrub species, and understory burning in conifer stands. Burning would be utilized both to consume vegetation that cannot otherwise be removed in order to reduce fire behavior in the event of a wildfire, and to restore the ecological benefits of low intensity fire in this fire adapted ecosystem.

Burning would generally be done following mechanical treatments that would reduce fire behavior by removing or rearranging natural fuels. Pile burning would be conducted in areas that have previously been thinned. Branches and needles, and other small diameter material would be piled to dry and burned under prescribed conditions. Broadcast burning may be used in some areas that have been previously treated as well as some untreated areas that have low to moderate natural fuel loading and fire behavior potential. Low intensity understory burning would also be used to reduce surface fuels and stimulate herbaceous growth under the tree stands. All prescribed burns would be done under manageable conditions and locations chosen to limit impacts while achieving the project objectives.

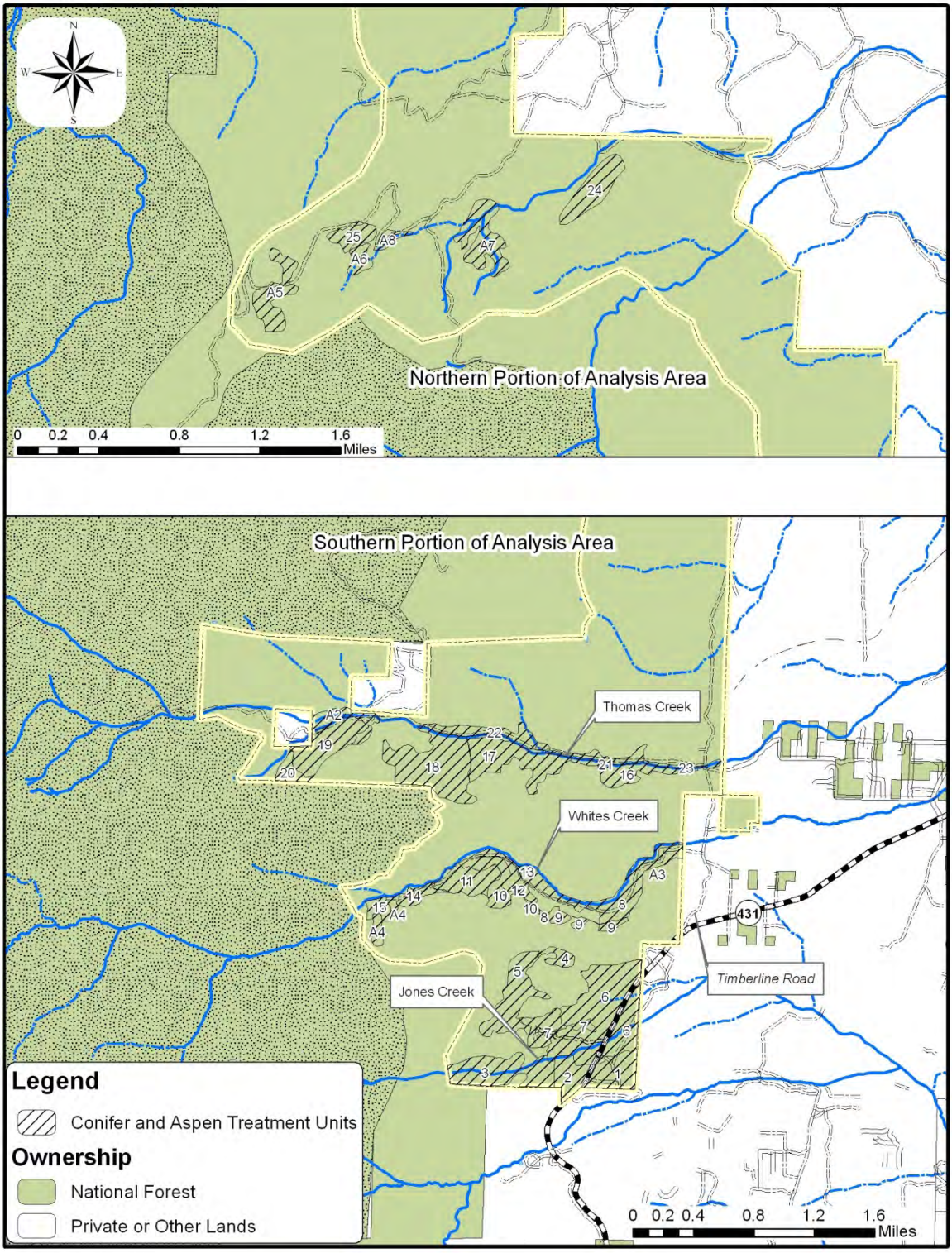
Burns would be conducted under conditions both cooler and wetter than are typical of wildfire conditions and detailed burn plans would be written and approved by required officials and air quality regulators. Burns would most commonly be conducted in areas that have received prior mechanical treatments, however they may be used in areas untreated by other means if conditions allow. Preparation of areas to be burned may include use of chainsaws and/or mechanical equipment to cut small trees and brush to create control lines to prevent fire escaping burn units. Because burn units would be determined as the project is implemented, specific resource protection measures for the burn units would be determined during the burn planning process.

Aspen Enhancement

It is usually difficult to get a fire to carry through a pure aspen stand, even in the understory, because of this aspen stands are often used as living fire breaks (Shepperd 2001). On approximately 118 acres, aspen stands would be enhanced and expanded through removal of encroaching conifers and stimulation of aspen regeneration. Treatment would include

removal of most conifers up to 30” diameter at breast height (dbh) from within and approximately 100 feet (1 ½ times the tallest aspen tree) from the edge of the existing stand.

Figure 3 Conifer and Aspen Treatment Unit Locations


N
W
E
S
Northern Portion of Analysis Area
0 0.2 0.4 0.8 1.2 1.6
Miles
Southern Portion of Analysis Area
Thomas Creek
Whites Creek
Jones Creek
Timberline Road
431
Legend
Conifer and Aspen Treatment Units
Ownership
National Forest
Private or Other Lands
0 0.2 0.4 0.8 1.2 1.6
Miles

If successful aspen regeneration, approximately 2,000 to 4,000 stems per acre, does not occur with conifer removal alone, the aspen stand would be under burned with a light intensity burn. In aspen stands where there is minimal conifer encroachment, but minimal to no aspen regeneration, a light intensity under burn would help stimulate aspen regeneration. Refer to figures 2 and 3 for areas where aspen enhancement would occur. (In figure 3 aspen treatments are labeled with an A before the unit number, i.e. A2).

Maintenance

Recurring treatments to maintain reduction of ladder and surface fuels and maintain the area with reduced fuels may occur as needed. Prescribed fire would be used to maintain treatments where possible, but brush and small tree mastication, and invasive weed treatments may also be included. Maintenance would also occur in areas that were treated in past projects prior to this proposed action but are within the project area as well as areas treated through this proposal. Re-treatment may occur within three years of the initial treatment and may continue, as needed based on vegetative response and effects monitoring.

Design features

Air Quality

- Prescribed fires are subject to permitting by the Washoe County Air Quality Management District (WCAQMD). For each prescribed fire, the Forest Service would have contingency plans identified to reduce smoke emissions. Contingency plans shall be implemented when the WCAQMD determines that acceptance limits of smoke are exceeded, and/or the Forest Service anticipated that the prescription for a prescribed fire would be exceeded.
- When mechanical fuels treatment operations occur, dust generated from dirt roads would be monitored for air quality compliance with the standards set forth by the WCAQMD.

Archeology

- Archeological sites would not be impacted by project activities:
- Wooden artifacts, features, or structures would be protected during burning activities.
- If previously unknown sites are encountered during activities, operations would stop and the district archaeologist would be contacted.
- Archeological sites would be flagged and avoided during project implementation. Trees would be directionally felled away from identified archeological sites, temporary roads, skid trails, and landings would be located to avoid archeological sites and no slash piles would occur in identified archeological sites.

Fire/Fuels

- All Federal, State and local regulations pertaining to prescribed burning and smoke management would be followed. A U.S. Forest Service (Region 4) burn plan would be completed and approved before burning is initiated.
- Prior to the burning season a news release would be distributed to media contacts and public notification would occur to advise the local community of the prescribed burning.

Noxious Weeds

- Contract equipment would be washed and inspected prior to entering National Forest System lands to remove any soil and debris that may harbor noxious weed seeds.
- Areas with higher concentrations of cheatgrass and/or medusa head would be evaluated prior to any prescribed burning and/or mastication activity to determine the risk of spreading these weeds following implementation. If the risk of cheatgrass spread is considered high, the site would be avoided or mitigated with pretreatment and seeding of native grasses. Only native seed mix, tested as weed free, would be used.
- Ongoing weed treatments would continue on known occurrences of noxious weeds in the project area. Heavily infested areas would be identified and avoided until weeds are eradicated or at levels low enough that the risk of spread in minimal.
- Known occurrences of noxious weeds would be managed. If road surface material is needed to repair roads, sources would be inspected and determined to be weed free.

Recreation

- Treatment in areas that are visible from system trails including Jones / Whites loop, Whites Creek Trail, Thomas Creek Trail, Dry Pond Trail and connector trails to the Galena Creek Visitor center and Jones / Whites Trailhead would be carefully considered and disturbance in the view shed minimized.
- Where treatments are necessary, decrease intensity of treatments along trails to reduce short term effects to the recreation experience, and discourage off trail use. Where feasible leave down woody material and brush along trails to reduce off trail travel proliferation of social trails.
- As much as possible hide evidence of treatments such as cuts, fire lines, evidence of motorized equipment, tire tracks, etc. in areas visible form trails.
- Techniques include includes raking, covering cuts with dirt, cut any stumps flush to the ground, returning fire lines to natural grade, cover ground disturbance such as fire lines with needles or woody material. As much as possible retain the natural appearance of treatment areas near these trails.
- It is preferred that trails be used as fire lines rather than constructing new line in areas visible from trails. If trails are used as fire lines, return woody debris (if available) to the edge of the trail to minimize off trail use and development of social trails. If trails are widened or trenched to make more effective fire lines, return the trail to original width or less than 30" and fill trenched areas / construct water bars to prevent erosion.
- Limit motor vehicle travel on these trails and hide or repair evidence of motor vehicle use associated with the project.

Soils/Water

The risk of impacts to soil and water would be reduced through implementation of the Best Management Practices (BMPs) identified below.

- Generally, ground based equipment would operate on slopes less than 35 percent (30 percent on decomposed granite soils), except for pitches of 150 feet or less. However,

mechanical mastication operations may occur on slopes up to 50 percent; these would be designed on a unit by unit basis only after soil stability, soil rock content and the location of the steep slope in relation to the remaining portions of the treatment unit have been determined to be appropriate by the Forest Service.

- Skid trails would be designated on ground based skidding units.
- Skid trails would be located to minimize soil disturbance and potential erosion.
- Rehabilitation of skid trails may include ripping, seeding and waterbar construction. Temporary roads would be obliterated. Native seed mix would be used during project rehabilitation efforts.
- Equipment exclusion zones would be established for both seasonal stream and perennial streams to protect stream bank stability and water quality. Equipment exclusion zones would be established within 50 feet of a seasonal stream and 100 feet of perennial streams.
- No trees would be removed where they provide stream bank stability.
- Ground based equipment would stay on designated stream crossings.
- Pile burning would be minimized in riparian conservation areas.
- Prescribed fires may back into riparian vegetation areas; avoid direct lighting within riparian vegetation
- Where fuel conditions allow, five to ten tons per acre of coarse woody debris, greater than three inches in diameter, would be retained.
- Designate sheep bedding sites away from streams and riparian areas. Designate watering areas for sheep.

Vegetation

- Skid trails would be designated on ground based skidding units and located so damage to the residual stand is minimized. Multiple pass skid trails would be located a minimum of 75 feet apart except where they converge at landings.
- In conifer thinning areas, all live conifers 24 inches dbh or greater would be retained; in aspen enhancement and plantation protection and enhancement areas, all live conifers 30 inches dbh or greater would be retained, exceptions are allowed to meet needs for equipment operability but would be carefully considered and minimized.
- Temporary roads would be obliterated; skid trails and landings would be rehabilitated.
- Where feasible, whole tree yarding, with limbs and tops attached, would be utilized to minimize burn intensity and reduce surface fuels.
- Pile burning would not occur within aspen stands.

Visual Resources

- Thin forest vegetation to achieve a more attractive, open and diverse condition that is more consistent with the historic range of the project area scenery, emphasizing the long-term presence of aspen and large conifer trees (>24”dbh) in a clumpy and irregular distribution.

- Long term visible vegetation damage, skidding, slash and soil exposure is minimized (to remain visually unnoticed from trails, trailheads and views into the project area from the Galena Visitor Center and the interpretive trail. This includes trails and trailheads at Thomas Creek, Whites Creek, and Jones Creek.
- Vegetation removal would be done in a manner that protects residual trees and ground cover characteristics from apparent damage.
- Create no long term linear lines or extreme soil disturbance that creates color contrasts or other noticeable contrasts.
- Mowing must be accomplished so as to mimic natural events that result in a characteristic landscape appearance (vegetation mosaics, differing heights and densities, etc.)
- Flush cut stumps within 50 of trails/trailheads.
- Tree marking within 50' from trails, trailheads, and the Galena Visitor Center and the interpretive trail is not readily visible from trails. This includes trails and trailheads at Thomas Creek, Whites Creek, and Jones Creek.
- Skid Roads and Landings: Utilize existing skid roads and landings to the extent possible.
- Retain natural appearing large snags and down logs when they do not pose safety or fuels hazards.

Wildlife/Sensitive Plants

- To minimize potential impacts, the perimeter of any newly detected population of Washoe tall rockcress would be flagged and excluded project activities.
- A Protected Activity Center (PAC) has been designated within the project area to protect nesting habitat for flammulated owls. To maintain habitat integrity within the PAC, the following vegetation prescription has been developed: Modify existing canopy cover no more than 10% in stands with canopy cover of 60% or more and modify no more than 5% in stands where canopy cover is less than 60%;
    - Brush thinning would be by hand and would retain at least 50-70% of the existing brush cover;
    - Tree thinning would be by hand and focused on existing dense patches of understory trees less than 12" in diameter;
    - Where feasible, two canopies of trees and shrubs would be maintained throughout the PAC;
    - All snags with existing cavities would be maintained;
    - Limited operating period from May 15- September 15; no project activities within the PAC during this period unless cleared through the District Wildlife Biologist
- To maintain habitat integrity in some portions of the project area, pockets of trees, up to 1 ½ acres in size, would be retained in some of the riparian and other upland areas. Wildlife pockets would include the following:

- A) Areas within 200 feet North and 300 feet south of Thomas Creek from the WUI defense zone to Thomas Creek meadows, b) areas within 300 feet of Whites Creek from the trailhead west, c) within 300 feet of Jones Creek, and d) within units 4, 5 and 7.
    - Wildlife pockets would occur in specified areas where canopy cover currently exceeds 50%, and large down woody debris and larger diameter snags exist.
    - The size of the tree pockets would vary and would be dependent on areas where specified conditions exist, however size would not exceed 1 ½ acres and pockets would be no closer than 300 feet.
    - Some thinning of trees across diameter ranges less than 18" dbh may occur within these pockets; however canopy closure would not be reduced below 50 percent. Preferable overstory trees include Jeffrey pine and aspen, though white fir overstory as well as understory trees may be retained.

- Within units 19 and 20, clumps of three to five trees at least 18" dbh and the existing understory trees in the clump would be retained. Outside the defense zone, one clump per acre would be retained, where the conditions exist. If possible, canopy closure within the unit would not be reduced below 40 percent, however if fuels reduction objectives cannot be met canopy closure would drop below 40 percent.
- Where available, three of the largest snags per acre would be retained throughout the project area; at the minimum three pieces of large woody debris, the largest available per acre, would be also be maintained throughout the project area;

    - Project activities would not occur in aspen and riparian areas April through July to minimize potential disturbance to migratory birds.
    - Prescribed burning sites would be surveyed for active bird nests immediately before burning occurs (within 1- 3 days). Active nests would be flagged and avoided within 50 feet of a nest site.

Monitoring

This project would use an adaptive management approach, in which treatments are implemented, monitored and adapted. Monitoring would determine if the desired conditions are being achieved. Adjustments to project prescriptions based on monitoring of the proposed action would not need a new decision unless they are determined to be outside the scope of the proposed action. Monitoring actions would include those in Table 1.

Table 1 Monitoring Actions Associated With Implementation of The Arrowhawk Fuels Reduction Project

Monitoring Actions	Method	Timing
Evaluate the effectiveness of	Field exams and	Pre and post project

fuels and forest health treatments in meeting project objectives	photo points	activities
Evaluate burning conditions, fuel consumption, and RX fire effectiveness	Observations and photos during and after burns	Pre, during and post burn
Evaluate effectiveness of aspen enhancement	Photo points	Pre and post activity
Ensure contracts are correctly implemented.	Inspections	During and post activities

Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in the table is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 2 Comparison of Alternatives

	Alternative 1 (No Action)	Alternative 2 (Proposed Action)
Air Quality	No Change to potential for large wildfire to contribute air pollution and greenhouse gases.	Short term smoke resulting from prescribed burns, Burns conducted within standards and permitted levels. Small contribution to greenhouse gases compared to wildland fire.
Cultural Resource	No Change to current Conditions. Continued threat to cultural artifacts from wildfire.	Implementation of design features would prevent effects to historic properties from the project
Fire Hazard and Fuels	No change, high potential for large high severity fires threatening communities and recourses	Reduced hazardous fuel accumulations, reduced potential for high severity fire negatively impacting human and natural recourses

Table 2 Comparison of Alternatives		
	Alternative 1 (No Action)	Alternative 2 (Proposed Action)
Noxious and Invasive Weeds	The area would remain vulnerable to increased infestations of cheatgrass and medusahead from recreation users, wildfire and other natural and human-caused disturbances	Implementation of the project design features would reduce the spread of noxious and invasive species. The use of sheep to graze cheatgrass as it greens up would reduce fire risk and cheatgrass spread.
Recreation	No change to current opportunities,	Short term impacts during project implementation activities on some user groups.
Roadless	No change	No change
Sensitive Plants	Continued risk of habitat alteration resulting from wildfire.	Reduced risk to habitat from wildfire short term risks to individual plants during implementation. Project activities are not likely to result in a trend toward Federal listing or loss of viability
Soil and Water	Continued risk of impacts to soil and water resources form wildfire	Reduced risks from wildfire. Short term risks from implementation activities. These are minimized by the implementation of Best management practices and design features.
Vegetation	Continued risk of uncharacteristic wildfire, increased density and insect related mortality and reduced stand vigor. Declining aspen stand condition and acres	Reduce fire risk, reduced density and insect related mortality, increased stand vigor and reduced conifer encroachment in Aspen stands, opportunity for aspen recovery.
Visual Resources	No Change to current visual quality, potential for adverse effects from large wildfires.	Short term changes resulting from vegetation treatment. Return to “natural” appearance after one or two seasons.

Table 2 Comparison of Alternatives		
	Alternative 1 (No Action)	Alternative 2 (Proposed Action)
Wildlife	Continued risks to individuals and habitats resulting from wildfire	Reduced risk from wildfire. Short term effects to individuals and habitat. Implementation of design features and should not likely to result in a trend toward Federal listing or loss of viability

ENVIRONMENTAL CONSEQUENCES

This section summarizes the physical, biological, social, and economic environments and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives.

The best data available were used in this analysis. The data in the following tables and in the project record depicts with a reasonable amount of accuracy what would be occurring on the ground for each alternative, within the limitations described above. The changes between alternatives remain relative to each other.

Most of the GIS data used in the following analysis are from the Humboldt-Toiyabe National Forest corporate geographic information system (GIS) layers. There is a certain amount of error in the location and alignments included in this GIS data and other National databases. The Forest is constantly working to improve map accuracies and the corporate GIS layers.

Cumulative Effects

According to the Council on Environmental Quality (CEQ) National Environmental Policy Act (NEPA) regulations, “cumulative impact” is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions (40 CFR 1508.7).

The cumulative effects analysis area is described under each resource, but in most cases includes the entire area of the Carson Ranger District including private and other public lands that lie within the district boundaries. Past activities are considered part of the existing condition and are discussed in the Affected Environment (existing condition) and Environmental Consequences section under each resource.

The CEQ issued an interpretive memorandum on June 24, 2005, regarding analysis of past actions, which states, “agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions.” In order to understand the contribution of past actions, including past development of unauthorized routes, to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects.

Activities to be Considered for the Cumulative Effects Analysis

To avoid repetition in individual resource discussions, potential projects or activities considered for the cumulative effects analysis are listed here and referenced, as appropriate, in the individual resource effects analysis. Cumulative impacts include those impacts

resulting from activities occurring in the project area in the past 20 years, are occurring presently, and/or are expected to occur within the next 20 years.

Current and reasonably foreseeable future actions include:

- Personal use Christmas tree, fuelwood and miscellaneous forest product sales, expected to continue in future years except in areas that already meet basal area, and snag and down log requirements.
- Recreational use – hiking, horseback riding, dog walking, mountain biking, snowmobile use, off-highway vehicle use.
- Previous fuels reduction projects on Forest Service lands, including the Whites Creek fuelwood removal project, Whites-Thomas creek canyon fuels reduction project and Hawken tree planting and personal use fuelwood removal.
- Hazardous fuels reduction projects on private lands.
- Continued road maintenance on National Forest System roads

Air Quality

Affected Environment

The existing sources of particulate emissions within and/or near the Arrowhawk analysis area include smoke from neighboring prescribed fire projects, residential wood stoves, and vehicular exhaust and dust. All of the project area falls within Washoe County, Nevada. This counties air quality is monitored and enforced by the Washoe County Air Quality Management District.

Environmental Consequences

No Action

In the absence of hazardous fuels reduction treatments, a high severity wildland fire could occur in this project area. This would cause short term adverse air quality impacts from smoke emissions. As an example the 3,100 acre Angora ire in 2007 release an estimated 190,000 tons of greenhouse gases and the decay of the trees killed by the fire could bring the total emissions to 794,000 tons (Malmsheimer et al. 2008). This is equivalent to the greenhouse gas emissions generated by 143,500 cars annually (Malmsheimer et al. 2008).

Proposed Action

Air Quality would be affected primarily by prescribed fire operations such as pile burning and/or understory burning following pretreatments of an area. Prescribed fires are subject to permitting by the Washoe County Air Quality Management District. For each prescribed fire, the Forest Service would have contingency plans identified to reduce smoke emissions. Contingency plans shall be implemented when the Washoe County Air Quality Management District determines that acceptable limits of smoke are exceeded, and/or the Forest Service anticipates that the prescription for a prescribed fire would be exceeded. Given these

conditions, it is unlikely that health risks from air quality would occur. However smoke generated from prescribed burning cannot be prevented and would likely be an annoyance to some individuals in local neighborhoods as well as to travelers through the area.

The Carson Ranger District would work with other National Forests and Districts, the Bureau of Land Management, the Nevada Division of Forestry, and local fire departments to ensure that multiple prescribed burns would not exceed air quality standards. When mechanical fuel treatment operations take place native surface roads would be monitored for air quality compliance with standards set forth by Washoe County Air Quality Management District.

Cumulative Effects

With the application of design features, there are no cumulative effects to air quality.

Cultural Resources

Affected Environment

The Arrowhawk project area has been an area of extensive prehistoric and historic use and occupation as evidenced by the many diverse archaeological sites. Archaeological surveys to date have found over 40 historic and prehistoric sites within the project area. More prehistoric sites have been identified to the east of the project area on the Mount Rose fan (adjacent to the project area). Prehistoric use of the project area is evidenced by the extensive village sites recorded by Intermountain Research in 1994 (Elston et al 1994). Historic occupation of the project area began in the mid 1880s as mining around Galena boomed and eventually turned lumber for the Comstock took over. A total of 47 previously recorded sites are found within the proposed project area. The sites are comprised of twenty historic sites with constructed features, three historic refuse scatters, four historic road or trail segments, nine prehistoric lithic scatters (one with petroglyph), eight multi-component sites (Prehistoric lithics and historic artifacts), and three sites with arborglyphs. Eleven sites within the project area are identified as eligible for inclusion to the National Register of Historic Places (NRHP). Thirty six sites have not been evaluated for inclusion to the NRHP.

Environmental Consequences

No Action

If no action is taken, the potential for high severity wildland fire burning through the area and destroying cultural resources would be far greater, as many fuels litter the ground within and around cultural resources. An example would be the potential loss of wooden elements of railroad grades and bridges constructed during the Comstock Era.

Proposed Action

The Forest consulted with the Nevada State Historic Preservation Office (SHPO) to complete archaeological surveys within the project area. In a letter dated March 12, 2012 the SHPO Concurred with the Forest finding that the proposed action would not pose and adverse effect

to any historic properties within the avoidance plan provided for this project. The avoidance plan is included as design features of the proposed action.

The Washoe Tribe of California and Nevada, and the Reno Sparks Indian Colony have been consulted on the project during two personal meetings with the tribes and by official correspondence. Neither tribe had comments or concerns related to the proposed projects. The district is continuing open communication with the tribes on findings.

Cumulative Effects

There are no effects to historic properties as a result of the proposed action therefore there are no cumulative effects.

Fire Hazard and Fuels

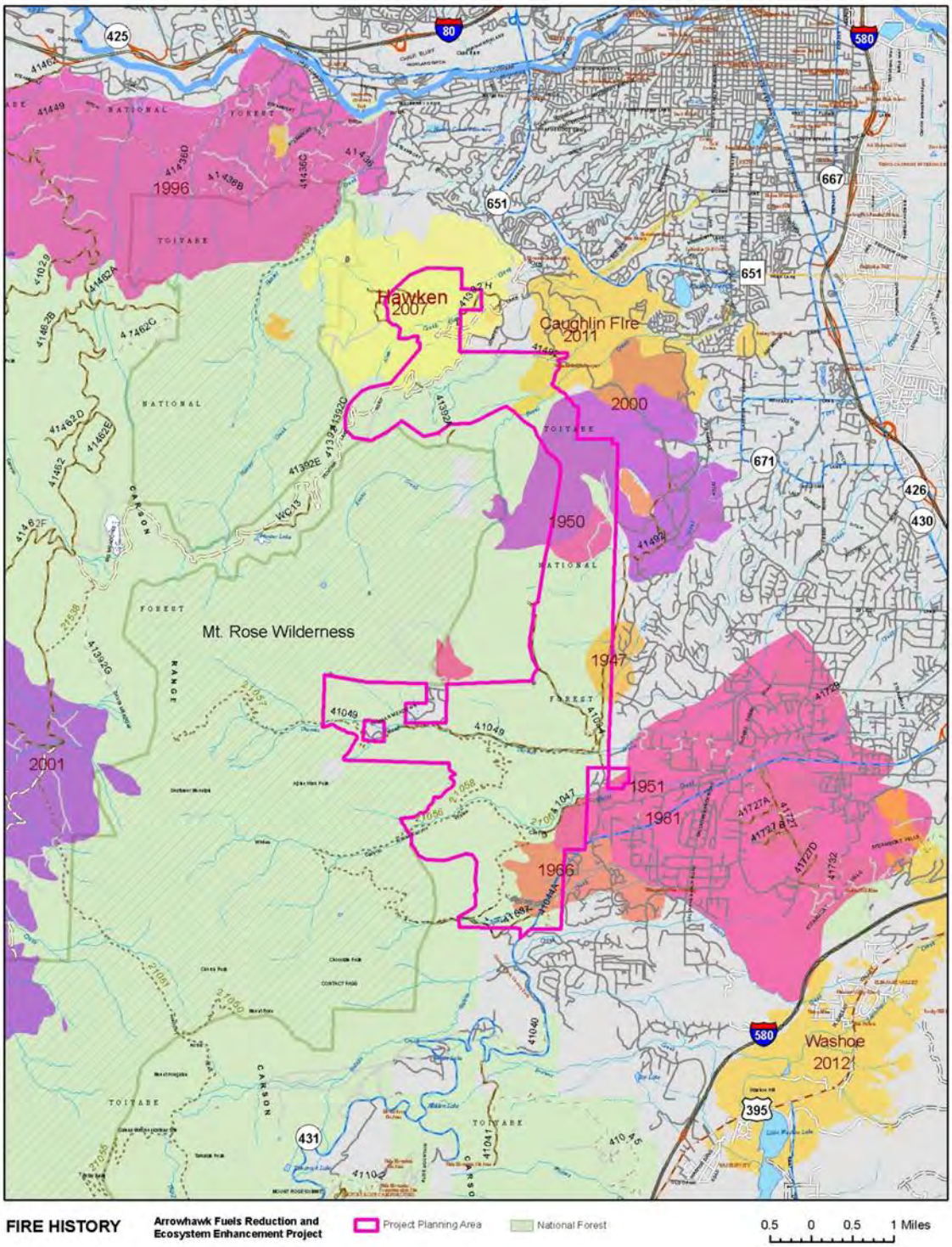
As can be seen in figure 4, the area has been nearly surrounded by large fires occurring during the last half century. Many of these fires reach multi-thousand acres in size. Although fire may be considered natural in this area, it is the size and intensity of these fires that are of concern. Fires that incinerate the majority of the vegetation over such extensive areas can have severe watershed and environmental effects that may not be natural or desirable, especially in close proximity to human dwellings.

Fire behavior potential for the Arrowhawk project area was analyzed both during the development of the Carson Range Multi-Jurisdictional Fuels Reduction and Wildfire Prevention Strategy of 2008 in cooperation with fifteen local, state and federal land and fire management entities, and during the preparation of the Environmental Assessment for the project itself. Results are somewhat variable among the techniques employed, however indicate that 62 percent or more of the project area is likely to support flame lengths exceeding the desired condition for wildfire within the Wildland Urban Interface (WUI) established by the Sierra Nevada Forest Plan Amendment of 2004.

Desired conditions within the WUI Defense Zone, the first one quarter mile in closest proximity to communities, should consist of fairly open stands of vegetation dominated primarily by larger, fire tolerant trees. Surface and ladder fuel condition should be such that crown fire ignition is highly unlikely, and the openness and discontinuity of crown fuels, both horizontally and vertically result in very low probability of sustained crown fire. Fire behavior analyses of existing fuels conditions predict that 13 to 33% of the project area would currently support some form of crown fire in conifer, hardwood, or large shrub species.

In addition, surface fires which do not burn canopy vegetation may produce enough heat to be lethal to many species. Heat generated is directly related to the amount, type, condition, and arrangement of existing fuels. In fact intense surface fire, producing mortality in trees as well as shrubs over extensive areas, is commonly observed in this locality in recent decades (Hawkin Fire 2007, Waterfall Fire 2004, Little Valley Fire 1986). Flame lengths predicted for much of the project area indicate fuel accumulations that could produce lethal fire effects to both surface and canopy vegetation.

Figure 4: Fire History in the Vicinity of the Project Area



Ninety nine percent of this project area falls within the Wildland Urban Interface (WUI) as defined by the Healthy Forest Restoration Act of 2003, the Sierra Nevada Forest Plan Amendment of 2004, and the Carson Range Multi-Jurisdictional Fuel Reduction and Fire

Prevention Strategy of 2008. Fire regime and condition class data was obtained using the national LANDFIRE database which has been developed to identify lands or communities with hazardous fuels build-up. Considering the impacts that have already occurred to the surrounding areas due to large wildland fires and the conditions existing within the analysis area, this project is being planned following the direction of the Healthy Forest Restoration Act (HFRA) of 2003.

Fire regime is a system of classifying both the natural and/or historic fire occurrence that existed across the landscape prior to effective fire suppression efforts. Fire Regime includes the frequency and type of fires that occur at a particular location over time. The degree to which the fire regime has been altered is described using broad condition classes.

Although the classes are general, they assist in understanding how human activities on a landscape have contributed to a broader reaching pattern of ecological change. Fire Regime Condition Classes describe a degree of departure from historic fire regimes which may indicate alterations in important ecosystem components such as species composition, structural stage, stand age, canopy closure, and fuel loadings. These factors in turn affect fire behavior, habitat, and soil stability. Knowing these elements for a landscape provides a means to approximate the percentage of each condition class within the analysis area (Table 3).

Table 3 Condition Class Description and Approximate Percentage Distribution Within the Analysis Area

Condition Class	Project Area	Departure From Natural Fire Regime	Condition Class Description	Examples of Management Options
1	16%	Low	1 - Fire regimes in this condition class are near or within the natural (historical) ranges. Vegetation composition and structure are intact. The risk of losing key ecosystem components from the occurrence of fire is relatively low. Fire frequencies have departed from historical frequencies (either increased or decreased) by no more than one return interval.	Where appropriate, these areas can be maintained within the historic fire regime through fire use or prescribed fire.
2	75%	Moderate	2 - Fire regimes and vegetation attributes have been moderately altered from their historical range. The risk of losing key ecosystem components has increased to moderate. Fire frequencies have departed by either increasing or decreasing from historical frequencies by one or more return interval resulting in moderate changes to fire size, frequency, intensity, severity, or	Where appropriate, these areas may need moderate levels of restoration treatments such as fire use, prescribed fire and hand or mechanical treatments to be restored to their

Table 3 Condition Class Description and Approximate Percentage Distribution Within the Analysis Area				
Condition Class	Project Area	Departure From Natural Fire Regime	Condition Class Description	Examples of Management Options
			landscape patterns.	historical Fire Regime.
3	3%	High	3 - Fire regimes and vegetation attributes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals resulting in dramatic changes to fire size, frequency, intensity, severity, or landscape patterns. Vegetation condition, structure, and diversity have been significantly altered.	To restore the historical fire regime these lands may require high levels of restoration treatments such as hand or mechanical treatments before prescribed fire can be utilized where appropriate.
NA	6%	NA	Urban, Agriculture, Barren, or Sparsely Vegetated	NA

Environmental Consequences

No Action

The No Action Alternative would mean no fuels treatments would take place and current management of the area would continue. The area would continue to be a highly used recreation area near the communities of Galena, Caughlin Ranch, and suburban developments of Reno. The vegetation in the analysis area would continue to grow and compete for available moisture increasing density related mortality and accumulation of fuels.

Fires would continue to be suppressed due to the proximity to development, meaning that that low intensity fires burning under mild conditions would be suppressed and their frequent, low severity impacts would continue to be removed from the ecosystem.

While it is not possible to predict exactly when or where fires would occur in the future, there are aspects of future fires that can be predicted. Considering the climate, frequency of ignitions, fuels conditions, and the history of large fire development nearby; it is highly likely that fires burning under conditions extreme enough that they escape early suppression efforts would continue to play a role in this landscape.

In addition to the direct threat from fire to the communities and the watersheds adjacent to them, uncharacteristic fire can have effects on the future forest as well. Fires not characteristic of the fire regime may lead to conditions more flammable than currently exist and lead to changes in the vegetative community. Of concern in this area is the opportunity for cheatgrass to proliferate after large fires which has been commonly observed in the local area. Cheatgrass is highly flammable and capable of carrying fire at greater frequencies than native vegetation.

Cheatgrass is not a concern for fire hazard and ecological reasons alone. Cheatgrass has a shallow root structure that is not effective at holding soil in place, which is especially important after extensive wildfires due the potential for large scale soil movement (Young & Clements, 2009). Soil that is free to move typically makes its way into stream courses having impacts on stream ecology and water developments.

Proposed Action

The proposed action would reduce surface fuels, ladder fuels, and decrease stand densities. Implementation would take place over ten or more years and would require regular maintenance. Potential fire behavior may also be decreased to meet the desired conditions within WUI at a relatively low cost when compared to the cost of suppressing large fires and rehabilitating severely burned areas post fire. Because 75% of the project area is still in Condition Class 2, treatments including mechanical fuel reduction and prescribed fire may be used very effectively to restore vegetation to a more natural condition for this forest type. Cost would also be significantly lower now when compared to the cost of waiting until the area advances into Condition Class 3.

Once initial fuel loadings are reduced much of the project area can be maintained through the use of prescribed fire, restoring the low intensity frequent fire that is typical of the major fire regime within the project area. Generally, the fire hazard would be reduced from very high in forty-four percent of the conifer stands to moderate or low in all stands post treatment. Mortality in conifer would be reduced from an estimated 94.5 percent before treatment to 14.6 percent after treatment in a wildfire burning under high fire behavior weather conditions.

Treatments in brush and shrub vegetation types would show less reduction in mortality due to their shorter height and closer proximity to surface fires. Higher mortality in shrub species is to be expected in the fire regime natural to the area, however the treatments proposed are designed to interrupt the horizontal continuity of the vegetation, as well as the vertical continuity which allows them to function as ladder fuels into the tree canopies. By breaking up the horizontal continuity of brush and shrub vegetation wildfires fires are less likely to cause high levels of mortality over extensive areas.

Canopy base height is the average height from the ground to the lower level of the tree canopy for the stand. Increasing the gap between surface and crown fuels is necessary to prevent crown fire initiation and is accomplished both by treating surface fuels and raising the canopy base height by removing ladder fuels. The proposed action would raise the average canopy base height in the conifer stands from 7.6 to 19 feet above the surface and reduce the potential mortality and fire hazard to moderate or low by reducing ladder and surface fuels.

Crown bulk density is a measure of the compactness of the overstory canopy and a reflection of its density. Reducing the crown bulk density below the 0.10 kg m^{-3} is generally recommended to prevent active crown fire from spreading through the tree canopy if crown fire becomes established (Scott and Reinhart 2001, Graham et al. 2004). All of the stands inventoried in the project area had bulk densities below this threshold and yet modeling has shown that pretreatment fire hazard and potential mortality is very high in forty-four percent of the stands. This is an indication that understory vegetation and smaller trees, which act as ladders for fire to climb into the canopies, are generally a greater threat to the stands than the density of larger trees.

Prescribed fires following mechanical treatments and biomass removal are expected to produce significantly less smoke than would be produced during wildfires. Smoke production for wildfire occurrence, both before and after treatment and under severe and moderate burning conditions, were modeled using Forest Vegetation Simulator (FVS) (Dixon 2011). Smoke production was predicted to be reduced by approximately 45 to 50 percent simply by burning under moderate fire conditions rather than high or severe fire weather conditions. Prescribed fire smoke reduction would show a similar trend.

Additionally, approximately 11% the total carbon contained in the vegetation on site, which could be released as smoke in a wildfire, would be removed prior to applying prescribed fire. Only about 7% of the existing carbon mass on site would be consumed during prescribed fires, the rest would be retained in the larger more fire resistant trunks and stems of the vegetation to be retained post treatment. By removing, burning, or otherwise treating the

more flammable components of the existing vegetation, the total amount of vegetation available to burn and produce smoke is expected to be decreased substantially.

The reduction in smoke production is the result of both reducing the amount of material consumed by fire, and burning under more moderate conditions. Much of the fuel that would be consumed in wildfire would have been removed from the site or would not be consumed due to prescribed burning conditions even milder than the moderate conditions modeled for wildfire. Prescribed fires would also take place over smaller areas, several weeks to months per year, distributed over 10 or more years. The result would be less smoke and greenhouse gas production distributed over a much longer period of time.

Cumulative Effects

The treatments proposed in this project combined with the work of the fire safe councils and local agencies within the communities would contribute to reducing the probability of large scale severe fire in the project area impacting the communities and creating unwanted ecological impacts.

Noxious and Invasive Weeds

Affected Environment

The Nevada Department of Agriculture (NDA 2012) maintains a list of "noxious weeds" that are subject to regulation or quarantine by county agricultural departments. Noxious weeds are a legal and regulatory designation and defined partially under Nevada Law as: "….. If a plant is found to probably be "detrimental or destructive and difficult to control or eradicate" (Nevada Revised Statute 555.005); weeds not naturally found or limited in distribution throughout the state; actively excluded from the state and actively eradicated wherever found (NDA 2012)." Invasive weeds are non-native plants that threaten wildlands and wildland ecosystems by displacing native species, through competition, hybridization, and/or alterations to biological communities (Bossard et al. 2000). Unlike noxious weeds, many invasive species do not have a legal designation; however, their impact on native ecosystems can be just as damaging.

Noxious and invasive weeds spread aggressively through wind, water, wild animals, birds, livestock, vehicles, and people. Vehicles or OHVs used in weed infested areas can spread weeds by transporting seeds or vegetation that becomes stuck in tire treads and with mud and other debris in the undercarriage of the vehicles. Infestations can begin miles away as seeds drop off. Other activities that cause soil disturbance particularly in areas next to or within currently infested sites, enables the establishment of new weeds.

The Carson Ranger District has an active and aggressive weed management program that includes annually mapping, treating, and monitoring noxious weeds throughout the district, including the Arrowhawk area.

Noxious weed surveys and treatment have been conducted within the Arrowhawk area since 2002 with the most recent surveys occurring in 2011. To date, noxious weed occurrences

are limited to very small infestations of musk thistle located in the Hunter Lake Road area. Individual non-native thistles have occasionally been detected in Whites and Thomas Creek as well. Invasive species such as cheatgrass and medusahead are more prevalent, particularly in the lower elevations of the project area. Cheatgrass is present intermittently throughout the lower elevations of the project area, with denser infestations occurring on south facing slopes in Whites and Thomas Creek corridors. Medusahead occurs in concentrated patches on private and county lands just east of the project boundary off Hunter Lake Road. Smaller infestations are also beginning to appear on National Forest System lands in this same area.

ENVIRONMENTAL CONSEQUENCES

No Action

Under the no action alternative, the area would likely remain vulnerable to increased infestations of cheatgrass and medusahead from recreation users, wildfire and other natural and human-caused disturbances. Targeted grazing would not be applied to dense cheatgrass areas. Dense patches of cheatgrass would continue to pose a fuels hazard as well as suppress native plant populations.

Proposed Action

Under the proposed action, targeted grazing would be used within the lower elevations of the project area where dense infestations of cheatgrass occur. Sheep would be used to intensively flash graze (graze for a short period) cheatgrass prior to seed maturity in the spring and again in the fall to reduce excessive cheatgrass cover and fuel loading (see ‘”Animal Treatments” in Proposed Action’ section). The use of targeted grazing would help reduce fuel loading while also reducing cheatgrass production allowing for potential restoration of native plant communities.

In other portions of the project area, activities such as mastication, tree thinning and other treatments may cause ground disturbance potentially leading to new infestations of cheatgrass and/or medusahead. In accordance with Forest Service Manual 2081.02, a Noxious Weed Risk Assessment was conducted to evaluate the potential risk of noxious and invasive weed invasion associated with the proposed action. Risk factors are based on known and potential vectors, habitat alterations; current infestations, project activities, and associated mitigations (design features). According to the Arrowhawk Fuels Reduction Weed Assessment (project file), the proposed project would contribute a low to moderate risk of spreading or increasing noxious and invasive weed infestations in the project area. A low to moderate assessment was determined due to the design features incorporated into the Proposed Action to reduce the potential for noxious weed infestations.

For example, to minimize the potential of cheatgrass spread following treatment, a greater percentage of vegetation would be retained in areas that are considered prone to cheatgrass infestation (i.e. southerly slopes, poor soil conditions, lack of shade etc.). These sites would be treated minimally during each entry to allow for monitoring of cheatgrass response. If cheatgrass becomes prevalent, fuels treatments would be discontinued until the cheatgrass is treated. In addition, sites that are currently infested with medusahead would be excluded from fuels treatment activities until they are chemically treated and considered to be in

controlled or eradicated status. Similarly, other newly detected noxious weeds infestations such as musk thistle would be treated prior to project activities occurring.

Recreation

Affected Environment

The project area has forested areas, shrub areas, and aspen stands that have lost vigor due to encroaching conifer trees and have minimal regeneration.

Recreation uses in the project area are limited to the Hunter Lake Road Area in the north and the Thomas creek and Whites creek areas in the south. The areas both are both popular and diverse in the recreation opportunities they provide. There are few developed recreation sites but many trails, and undeveloped opportunities. As both areas are very close to the large urban population center, visitors flock to the areas in all seasons to enjoy the close access to the National Forest. Portions of Whites Creek trail, Jones/Whites Trail, Dry Pond Trail and connector trails to the Galena Creek visitor center and Galena Creek County Park are within the project area. These trails are all heavily used in the spring, summer and fall and are highly valued recreation opportunities for hikers, bikers and equestrians.

Environmental Consequences

No Action

Not implementing the proposed action could have negative effects on the recreation opportunities resulting from a catastrophic wildfire.

Proposed Action

The proposed action would maintain current recreation opportunities. Existing roads would continue to be open for non-motorized activities including hiking, biking and equestrian use. This project would reduce the risk of catastrophic fire that could damage or destroy the forest character that attracts people to this area for the many recreational opportunities.

Direct effects from implementing this project may include temporary closure of popular recreation areas during project implementation activities. These would likely be fairly short one –two weeks in duration. Temporary road closures during prescribed fire operation periods may also limit recreation access at times. Public notification and signage would be part of the implementation to limit the impact on the recreating public. Visitors on trails may notice treatment areas or implementation of treatments. This may temporarily affect the experience of trail users. In the long term, treatments associated with this project are designed to bring the area closer to its natural state and reduce the risk of catastrophic fire. Long term effects are generally beneficial.

Indirect effects may include increasing the size and numbers of dispersed recreation areas within the conifer and aspen stands. Tree spacing would be increased and hiking through the area may be easier for cross country travel.

Cumulative Effects

There are no foreseen cumulative impacts to recreation under the proposed action.

Inventoried Roadless Areas

Affected Environment

There are seven inventoried roadless areas partially located within the boundaries of the Arrowhawk Fuels Reduction and Ecosystem Enhancement project (Table 4). Combined these IRA occupy approximately 6.493 acres of the project area.

Table 4 IRA Within the Arrowhawk Analysis Area

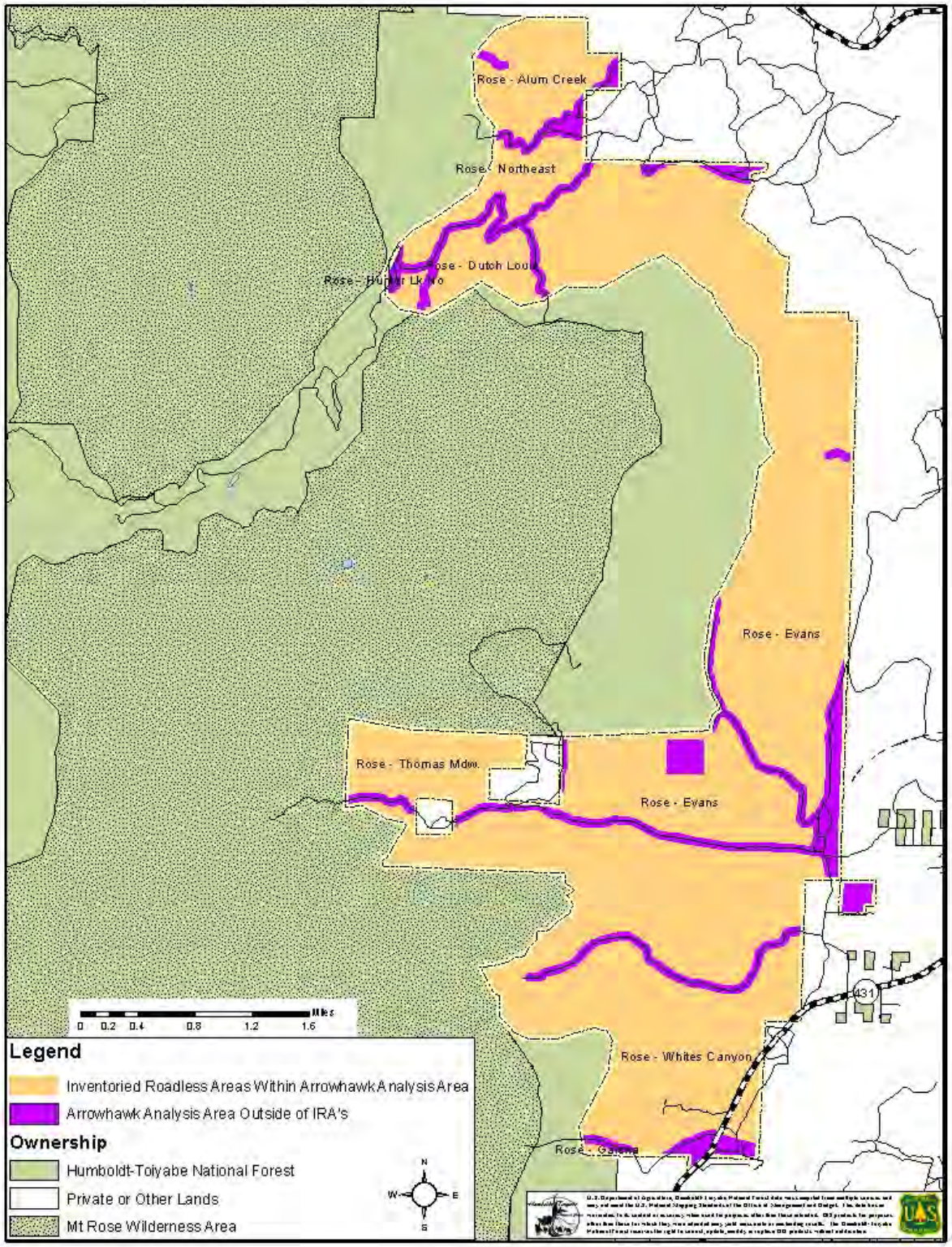
Inventoried Roadless Area Name	Acres	Percent of Analysis Area
Rose –Alum creek	359	5%
Rose-Dutch Louie	226	3%
Rose-Evans	2,944	39%
Rose-Galena	11	<1%
Rose-Northwest	234	3%
Rose-Thomas Meadows	355	5%
Rose-Whites canyon	2,364	32%
Total	6,493	87%

In 1998, the Humboldt-Toiyabe National Forest began reviewing unroaded areas with new GIS information (Cartographic Feature Files for NFS and Digital Line Graphs for adjoining BLM areas) to determine where there were 5,000 acre blocks of 'natural' landscapes (Humboldt-Toiyabe National Forest1998). This inventory was completed in 1999 and, then in 2001, when the Roadless Rule was created, this new inventory became the basis of the Forest's Inventoried Roadless Areas (IRAs).

As a result the Forest Service is required to consider the effects of projects on roadless characteristics and wilderness attributes when they occur within an inventoried roadless area

Many of the roads in the analysis area are "cherry-stemmed"; indicating there is no IRA adjacent to these roads for a distance of approximately 200 feet either side of the road (Figure 5). The 2001 Roadless Area Conservation Rule (36 CFR 294) was effective March 13, 2001 (USDA 2001).

Figure 5: Arrowhawk Roadless Areas



Environmental Consequences

No Action

There would be no direct or indirect effects upon the roadless and wilderness characteristics identified above from the No Action Alternative. The no action alternative involves no treatments or other associated management actions which would alter IRA characteristics or wilderness attributes. Because there are no direct or indirect effects on roadless or wilderness characteristics, there would be no cumulative effects as a result of this alternative.

Proposed Action

The proposed Arrowhawk Fuels Reduction and Ecosystem Enhancement project would have minimal impacts on the overall integrity of the seven IRA's. There would be short-term impacts associated with prescribed fire and mechanical treatments; however, these impacts would show recovery within several seasons and in the long-term these impacts would be very hard to distinguish.

This proposal does not involve road construction and is not within areas recommended for wilderness designation in the 2006 Humboldt-Toiyabe National Forest Assessment for Potential Wilderness (Humboldt-Toiyabe National Forest. 2006). Further, the proposed timber cutting is geared toward generally small diameter trees and intended to correct past ecosystem disturbances. What constitutes a generally small diameter tree would consider how the cutting or removal of various size classes of trees would affect the potential for future development of the stand, and the characteristics and inter-relationships of plant and animal communities associated with the site and overall landscape. Site productivity due to factors such as moisture and elevation gradients, site aspect, and soil types would be considered, as well as how such cutting or removal of various size classes of standing or down timber would mimic the role and legacies of natural disturbance regimes in providing the habitat patches, connectivity, and structural diversity critical to maintaining biological diversity.

Cumulative Effects

As there would be no longer term effects to roadless area characteristics or wilderness attributes in the seven inventoried roadless areas within the project area there would be no cumulative effects.

Sensitive Plants

Affected Environment

FEDERALLY LISTED THREATENED OR ENDANGERED SPECIES

The U.S. Fish and Wildlife Service species list obtained for the project area (Ref. No 2012-SL-0071), no Threatened, Endangered, or Proposed species have potential to occur in the project area. Webber ivesia was included on the list as a Candidate species with potential to occur in the project area. Webber ivesia is also a Forest Sensitive species and was analyzed in the Biological Evaluation for this project (refer to project record for complete evaluation).

Three rare plant species, Sierra Valley ivesia, altered andesite buckwheat, and altered andesite popcornflower are known to occur within the project area. Potential habitat is also present for the following species: Galena Creek rockcress, Shevock's bristle moss, Washoe tall rockcress, and slender, dainty, and upswept, and moosewort ferns.

FOREST SENSITIVE SPECIES

A Biological Evaluation (BE) was conducted for the Arrowhawk Fuels Reduction Project to analyze impacts to USFS Region Four Forest Sensitive species which have potential to occur in the project area (project file). Based on this analysis, the following plant species were determined to potentially be impacted from the proposed action:

- Galena Creek rockcress
- Washoe tall rockcress
- Altered andesite buckwheat
- Altered andesite popcorn flower
- Dainty, slender, upswept moonwort
- Moosewort
- Sierra Valley Ivesia
- Shevock's bristle-moss

Galena Creek rockcress (Arabis rigidissima var. demota)

Galena Creek rockcress is a geographically restricted regional endemic, which is known only from the Carson Range of the Sierra Nevada in Washoe County, Nevada, and just recently reported in southern Placer County, California. There are 39 known occurrences (0.1 mile separation) with over 10,000 individuals (Morefield, 2001) in Nevada with two additional populations in California (CNPS 2012). It has been documented from the vicinity of Mt Rose summit, Galena Creek and the upper elevations of Whites Creek within the Mt. Rose Wilderness.

Habitat for Galena Creek rockcress includes open, rocky areas along forest edges or openings within conifer and aspen stands or brushy slopes between 7,500 and 10,000ft. It is found on moderate to steep northerly aspects in moisture accumulating micro-sites. It is associated with sandy to rocky soils or outcrops or volcanic materials in western white pine, red fir, Jeffrey pine and aspen associations.

Washoe Tall rockcress (Arabis rectissima var. simulans)

Washoe tall rockcress is ranked 1 (critically imperiled) at the global and state levels by the Nevada Heritage Program, and is on the Threatened list of the Nevada Native Plant Society. Washoe tall rockcress has been documented from only 8 sites in northwestern Douglas County in the Spooner Summit area, and southwestern Washoe County, Mt. Rose vicinity, including Galena County Park, Nevada.

Washoe tall rockcress has been found only in dry, deep, sandy, granitic or andesitic soils on mostly gentle slopes of all aspects, in filtered sunlight of thinly-littered openings in mid- to somewhat late seral Jeffrey pine/Sierra Nevada white fir forests between 6035 and 7335 ft. elevation (Morefield 2002). Associated species include; mountain big sage (*Artemesia tridentata* ssp. *vaseyana*), Malhalla mat (*Ceanothus prostratus*), Tobacco brush (*Ceanothus velutinus*), green-leaf manzanita (*Artostaphylos patula*), bitterbrush (*Purshia tridentata*), squirreltail (*Elymus elymoides*) and *Penstemon* sp.

Fire suppression activities such as construction of fuel breaks, staging areas and landing pads may impact plants and potential habitat. Additional threats include timber harvest activities, road and trail construction and maintenance. Botanical surveys in 2009, and revisits to specific portions of the project area in 2010 and 2011 did not detect presence of the rockcress. The nearest known occurrence for this plant is approximately one mile from the project boundary.

Sierra Valley ivesia

Sierra Valley ivesia occurs in Plumas and Sierra counties in California and Storey and Washoe counties in Nevada. In Nevada it is known from the Carson and Virginia ranges and from Peavine Mountain (Morefield 2001). This portion of the population has been estimated at 2,800,000 plants in seven populations covering 9.7 acres (3.9 ha) (Witham 2000).Additional potential habitat within the project area was identified and surveyed without detection of the Sierra Valley ivesia (Witham 2000).

Sierra Valley ivesia is a long lived perennial plant that grows on shallow, vernally saturated, slowly draining, sandy to rocky clay soils, or alluvium on benches and flats in meadows, seeps, and intermittent drainages in the yellow-pine, mountain sagebrush, and mountain mahogany zones. The habitat supports a sparse to moderately dense vegetation type usually dominated or co-dominated by Ivesia aperta var. aperta (Witham 2000). It is known to occur 6,460 to 7,300 feet (1,969-2,225 meters) in Nevada and 4,855 to 7,545 ft. (1480 - 2300 meters) in California (CNPS 2012, Morefield 2001).

Sierra Valley ivesia can be impacted by road development and maintenance, and off road vehicle use. It is vulnerable to fire suppression activities, drying of habitat by water diversions, and invasive weed colonization (Witham 2000a). Based on long-term demographic monitoring within populations grazed by either cattle or sheep, Dittes (2000) noted that grazed populations have lower recruitment rates than ungrazed populations and also have a higher mortality of established plants.

Altered andesite buckwheat (Eriogonum robustum) and Altered andesite popcorn flower

The range of altered andesite buckwheat and the popcorn flower lies along the eastern edge of the northern Sierra Nevada and the adjacent edge of the Great Basin Division of the Intermountain Flora region; specifically the Reno section (Cronquist et al 1972). Altered andesite buckwheat is endemic to southern Washoe County and extreme western Storey County, Nevada, in the Virginia and Carson ranges, and on Peavine Mountain and the Red

Hill area. Altered andesite buckwheat is known worldwide form 129 sites in about 14 scattered groups and altered andesite popcorn flower is only known from approximately nine occurrences (Morefield 2001).

Altered andesite buckwheat and altered andesite popcorn flower occupy soils of andesitic, rhyolitic and sometimes granitic origin. Nearly all known populations of these plants occur on Smallcone soils which are characterized as harsh and acidic (Morefield 2000). These highly acidic soils typically also support sparse woodlands of Ponderosa and Jeffrey pine. These plants may occur on a variety of aspects and landforms, including ridgelines, low knolls, and very steep to nearly flat slopes.

Shevock's bristle-moss (Orthotrichum shevockii)

Shevock's bristle-moss is a rare endemic known from the Eastern to Central Sierra Nevada Mountains of California and the Western edge of Nevada. Within the Carson Range, the moss has been recorded on the west slope adjacent to the Chimney Rock Beach and also in the vicinity of Spooner Summit on lands administered by the Lake Tahoe Basin Management Unit (Cheryl Beyer, Forest Botanist LTBMU, personal communication). To date the Shevock's bristle-moss has not been documented from the Arrowhawk project area.

The bristle-moss occurs on the under hangs or within the crevices of granitic boulders within both pinyon – juniper woodlands and Jeffrey pine forest. The moss is recognized as occurring within extremely dry environments (Lewinsky-Haapsaari et. al.1998). Its location on the rock surface is within a setting of diffused versus direct light where the bristle-moss forms small patches or turfs.

Moonworts and Moosewort Ferns

The Botrychium complex, inclusive of the moonwort ferns, is associated with wet to moist meadow type habitats, (a designation which is inclusive of small springs, seeps and riparian vegetation) lakesides, and high elevation cirque habitats. Upswept, dainty, and slender moonworts and moosewort ferns have been listed as sensitive across the western Forest Service Regions based on rarity. In addition, an association with calcareous substrates (soils derived from limestone, dolomite, and certain volcanics) has been observed with the presence of botrychiums (Don Farrar, 2005 e-mail, project files) (Johnson-Grohl et.al. 2002a.).

Upswept Moonwort, (Botrychium ascendens): Upswept moonwort is ranked as a G2G3 S1 species (CNPS 2012). It is designated as a sensitive species in both Forest Service Regions 4 and 5. It is listed by the U.S. Fish and Wildlife Service as a Species of Concern. The Nevada Heritage program also lists this fern as a sensitive species. The population trend is unknown in Nevada (Morefield 2001). Currently in Nevada, upswept moonwort is known from occur the Spring Mountains between 8,891 and 11,155 foot elevation (Morefield, 2001) and the west slope of the Carson Range between 7,000 and 7500 ft., elevation. Associated habitat for upswept moonwort includes grassy fields, near streams in coniferous woods, and meadows.

Dainty Moonwort, (Botrychium crenulatum): Dainty moonwort is ranked as a G3 S1 species (CNPS 2012). Dainty moonwort has been designated as a Sensitive Species in both Forest Service Regions 4 and 5, and by the Nevada Heritage Program. The U.S. Fish and Wildlife Service have listed this plant as a Species of Concern. In addition it is on the Nevada Natural Heritage Program At-Risk List and Nevada Native Plant Society Watch List (NNHP 2004). The trend for this species is unknown in Nevada. Habitat for this plant includes lower montane coniferous forests, wet meadows, marshes, bog-fen habitat types and springs (CNPS 2012, Morefield 2001, USDA 2001). Dainty moonwort occurs at relatively high elevations in Nevada (7,900 to 11,150 feet). In Nevada, this small perennial fern is known from 9 occurrences (5 in the Spring Mountains NRA, 2 in the Ruby Mountains RD, one on the Jarbidge Ranger District and one on the Inyo National Forest). Within Nevada, potential habitat is present in many of the upper elevation mountains which intercept more precipitation (Morefield 2001).

Slender Moonwort, (Botrychium lineare): Slender moonwort is ranked as a G1 species. In 2001, slender moonwort was designated a candidate species for listing under the Endangered Species Act (USDI 2001). This fern is listed as Sensitive for both Forest Service Regions 4 and 5. The nearest known population of slender moonwort occurs on the Bridgeport Ranger District in Mono County, California. This population occurs on private land located in riparian vegetation supported by a hillside spring. The second site is situated in riparian vegetation immediately adjacent to a small stream.

Moosewort (Botrychium tunex): Moosewort is ranked as a G2G3 species recognizing a restricted range of distribution for this botrychium fern and rarity (CNPS 2012). The plant is listed as sensitive for several of the western regions of the Forest Service, and has been assigned an S1 rank by the Nevada Heritage Program indicating critical imperilment within the state of Nevada. Within mountain habitats the fern occurs on sparsely vegetated alpine scree slopes. In Nevada the moosewort fern is known from the Spring Mountain Range, associated with springs supporting a dense riparian plant community from 8,000 to 10,000 ft. elevation .

Any activity that reduces shading, soil moisture, or disrupts the organic matter would disrupt the micorrhizae community, which is critical to the survival of these ferns (Don Farrar, 2005 e-mail). The project area contains limited habitat for botrychiums. The drainages within the project area are mostly lined by steep slopes with xeric plant communities and lack the wet seeps and more meadow like conditions typically associated with botrychiums. Potential habitat does occur in Thomas Creek Meadow and adjacent aspen stands. Rare plant surveys conducted in 2010 resulted in no detections of botrychiums.

Environmental Consequences

NO ACTION

Forest Sensitive Plants

In the long term the most likely consequence of the no action alternative would be habitat destruction by a severe wildfire. Fires similar to the Martis fire in 2001 and the Waterfall fire in 2004 have been stand replacing fires that leave very little habitat for plants. Although implementation of this project does not guarantee such a fire would not occur, fuels

treatments would lower the risk by reducing fuel loading throughout the project area. In the short term under the no action alternative, habitat would continue to be available for sensitive plants that exist within the project area.

In areas that lack natural disturbance, the brush and forested stands would continue to become denser, lowering or improving habitat quality as the species require. Aspen stands, which are considered one of the most important habitat types for a variety of plant would continue to decline in vigor and health due to increased encroachment from conifers. Under the No Action alternative, no measurable impacts to rare plant species are expected to occur.

PROPOSED ACTION

Galena Creek rockcress

Documented occurrences of this plant were recorded by Nelson (1989) in the upper portions of Thomas Creek. Surveys of the area during the 2010 and 2011 field seasons did not detect the rare plant. However, seed emergence and blooming periods may fluctuate for plants depending on the yearly variation in climatic conditions.

Direct impacts to Galena Creek rockcress are not anticipated based on the lack of detection during project field surveys. Indirect impacts of the proposed treatments to potential habitat for Galena Creek rockcress include an increased risk of invasive species from site disturbance and reduced canopy cover. Establishment of early seral native plants on the site could slow or prevent establishment of the rare rockcress. The vegetation treatment proposed for the upper portion of Thomas Creek includes hand thinning and pile burning of forest understory vegetation. Heavy equipment will not be used. While this activity will disturb soil and duff layers it will not be as extensive as machine logging or mastication.

In addition slash pile burning, if allowed to get too hot, may alter the chemical, physical and biological properties of the soil (USDA 1979). However, pile burning will occur in late fall, winter, or early spring with appropriate humidity and soil moisture to prevent scorching residual vegetation, soil and also to contain the fire. Overall, the activity will enhance potential habitat for Galena Creek rockcress by creating openings and reducing the layer of forest duff.

Ongoing surveys will be conducted within the project area prior to implementation. If Galena Creek rockcress is detected, individual plants will be flagged and excluded from project activities. For a larger group of plants, the perimeter of the population will be determined and flagged to exclude project activities. For both individual and groups of plants a 50 ft. buffer will be applied to maintain rare plant habitat by excluding project activities

Cumulative Impacts

Galena Creek rockcress may be declining in some areas due to increased canopy closure. Fuels reduction work completed through the Arrowhawk project may open forest canopies and may potentially improve habitat for Galena Creek rockcress in some areas.

Determination

The Forest Service botanist determined that the proposed project may have minor impacts to potential habitat, but is not likely to result in a trend toward Federal listing or loss of viability for Galena Creek rockcress.

Washoe tall rockcress

Washoe tall rockcress has been documented as occurring within the near vicinity of the Arrowhawk project area at Galena County Park (approximately one mile away). Surveys of the area during the 2010, 2011 and 2012 field seasons did not detect the rare plant. Seed emergence and blooming periods may fluctuate for plants depending on the yearly variation in climatic conditions.

Because Washoe tall rockcress is not known to occur in the project area, direct impacts to Washoe tall rockcress are not anticipated. Surveys for Washoe tall rockcress will be ongoing until project implementation. If Washoe tall rockcress is detected, individual plants will be flagged and avoided during project activities.

Indirect impacts to potential habitat could include soil compaction in the vicinity of skid trails and landings and introduction of invasive species including cheatgrass or weedy early seral plants in areas of soil disturbance. Landings are located on flat terrain which often corresponds with potential habitat for the rare rockcress. In densely canopied areas, Washoe tall rockcress, which is associated with forested stands that allow diffused lighting, may benefit from some thinning and reduction in canopy and duff layers. However, large reductions in canopy cover can indirectly impact Washoe tall rockcress by over-exposing plants to sunlight. To minimize potential impacts, the perimeter of any newly detected population will be flagged and excluded project activities. For both individual and groups of plants a 50 ft. buffer will be applied to maintain rare plant habitat by excluding project activities.

Cumulative impacts

While there is a potential for indirect effects on this species it is not anticipated that these incremental effects when combined with other activities occurring in the cumulative effects analysis area would lead to a decline in populations or a reduction in in habitat size or quality. This is because the indirect effects associated with this undertaking may improve habitat in areas where the canopy is thinned and the duff layer is reduced. If Washoe tall rockcress is detected, individual plants/populations would be flagged and avoided during project activities.

Determination

Based on the above assessment, there would be no impacts to Sierra Valley ivesia and no further analysis would be conducted for this species.

Sierra Valley ivesia

Sierra Valley ivesia is known to occur within the project area on open, meadow-like areas on distinct rocky benches which are vernally saturated. These areas would not be subject to mastication, tree thinning or prescribed burning due to the lack of vegetation and therefore fuels hazard. However, targeted grazing may occur adjacent to these areas to reduce cheatgrass populations. To avoid impacts to Sierra Valley ivesia, all occupied and documented potential habitat for this plant would be fenced and/or flagged and would be completely excluded from all project activities, including targeted grazing.

Determination

There would be no impacts to Sierra Valley ivesia and no further analysis would be conducted for this species.

Altered andesite buckwheat and popcorn flower

Both the altered andesite buckwheat and altered andesite popcorn flower have been documented from the vicinity of the Hunter and Alum Creeks within the project area. These plants tend to occur on highly acidic soils with sparse vegetation. Trees may be present on these soils but are widely spaced, and stand understory development is lacking. Due to the lack of dense vegetation, no fuels treatments are proposed in these sites. However, to avoid potential impacts from equipment accessing other areas for treatment, these sites would be flagged and complete avoided during project activities. These areas would be identified on the ground by the district botanist or botany crew and would be omitted from treatment. In addition a thirty foot buffer would be observed at these sites to prevent any incidental impacts from the proposed treatments.

Determination

There would be no impacts to altered andesite buckwheat or altered andesite popcornflower and no further analysis would be conducted for these species.

Shevock's moss

Granitic rocks which provide potential crevice and overhang habitat for Shevock's bristle-moss are at the minimum five ft. in size (USDA 2009). Based on field observations, granitic rocks or outcrops with the needed dimension are limited within the project area. To avoid potential impacts to Shevock's moss from project activities all granitic rocks five feet in dimension would be avoided during treatments. To prevent scorching and/or overheating of Shevock's bristle-moss plants and/or habitat, pile burning activities would not occur within 30 ft. of large granitic rock. During prescribed fire underburns, shrubs adjacent to the granitic rock outcrops may be removed by hand and burned away from the outcrop feature.

Determination

There would be no impacts to Shevock's bristle moss and no further analysis would be conducted for these species.

Upswept, Dainty, and Slender Moonwort Ferns and Moosewort Fern

Botanical surveys did not detect moonwort ferns. Potential habitat for these ferns was identified within some aspen stands and riparian areas within the project area. Because moonwort ferns spend the majority of their lifecycle underground, and are very small in size (often 2" tall), there is a potential to overlook occupied habitat even during focused moonwort surveys. Therefore, it is assumed for the purposes of this analysis that all identified potential habitat is also occupied.

Depending on the lifecycle stage of botrychiums when treatments are conducted, direct impacts to Botrychium ferns could include trampling or crushing above ground vegetative and reproductive parts (summer to fall), or crushing the underground portions of the plant (year round) by a felled tree, machinery or foot traffic. As Botrychium ferns spend the first phase of life underground, undetected individuals could be impacted by crushing due to soil compaction. Spores from the moonworts are produced above the ground where they filter into the soil and germinate underground. Following germination, a significant portion of the moonwort life cycle is then spent below the ground where reproduction occurs and the offspring can remain for a number of years (Johnson-Grohl et.al. 2002b). An additional direct impact could occur if broadcast under-burning consumes plants, but this impact is likely to be negligible as Botrychium ferns tend to occur in habitat with high moisture. Furthermore, studies have shown that botrychium ferns are not directly impacted by fire unless the temperature is extreme (Johnson-Groh and Farrar 1996).

Indirect effects to Botrychium ferns include the potential for soil disturbance and increased vulnerability for occupation of the site by non-native plants. The removal of surface litter would increase solar radiation to the site causing drying of the soil and compromising the fern habitat. An additional indirect effect would occur if project disturbance interrupted the hydrology of the site, again leading to a drying trend and alteration of site features critical to Botrychium fern habitat.

Potential habitat which is adjacent to the Thomas Creek meadow and the aspen stands in the upper portions of this drainage would be re-surveyed prior to project implementation. With the documentation of Botrychium ferns listed as sensitive within the project footprint, an exclusion zone would be designated to avoid plants and habitat during project activities; the perimeter of the plant occurrence would be determined with a 100 ft. buffer and flagged to preserve occupied habitat.

Cumulative impacts

While there is a potential for indirect effects on Botrychium ferns it is not anticipated that these incremental effects when combined with other activities occurring in the cumulative effects analysis area would lead to a decline in populations or a reduction in habitat size or quality. This is because the indirect effects associated with this undertaking may improve

habitat in areas where the canopy is thinned and the duff layer is reduced. With the establishment of the exclusion zone to avoid both plants and habitat the indirect effects would be kept to a minimum. Similar population and habitat protection measures are included in all reasonably foreseeable projects that may impact Botrychium ferns within the cumulative effects analysis area.

Determination

The proposed action may impact individuals but would not lead to a trend toward Federal listing.

Soils and Water

Affected Environment

The Arrowhawk project area lies within the Truckee River watershed and is bisected by several streams, including Jones Creek, a tributary to Galena Creek, Whites Creek, Thomas Creek, Dry Creek and Evans Creek. These streams originate on the east slope of the Carson Range. Thomas Creek, Whites Creek, and Galena Creek flow through the National Forest and private lands and then into Steamboat Creek, which flows north through the Truckee Meadows and into the Truckee River.

The reaches of these streams which flow through National Forest Lands are considered Class A waters by the State of Nevada. Beneficial uses for Class A waters include municipal or domestic supply, aquatic life, propagation of wildlife, irrigation, watering of livestock, recreation including contact with the water and recreation not involving contact with the water (NDEP). Both White's Creek and Thomas Creek are on Nevada's 303(d) Impaired Waters List. Whites Creek is listed for boron, zinc and arsenic, and Thomas Creek is listed for zinc. Monitoring stations for both streams were established in 1998 near the forest boundary and have been sampled periodically through 2008 (NDEP). The priority for developing remediation plans for both streams is low.

Precipitation in the project area is approximately 30 to 40 inches a year (WRCC). Most of this precipitation comes as snow between October and May. This area also occasionally receives mid-winter rain on snow events and severe summer thunderstorms, which can result in heavy runoff. The United States Geologic Survey (USGS) has a long-term stream gage on Galena Creek, near the project area. Records indicate that peak flows since 1985 have been below 200 cubic feet per second (cfs), with the exception of 1997. The large rain-on-snow event that year resulted in a peak flow of 2,600 cfs.

Soils in the project area are derived primarily from volcanic parent material, with a small amount derived from granitic rocks and glacial till (NRCS 2011). The primary soil types are the Fraval-Booford-Jumbo association and the Fraval-Hirschdale-Jumbo association. Both these soil associations are primarily cobbly or stony loams derived from volcanic or andesitic rock. The soil erosion factor "K" indicates the susceptibility of an undisturbed soil to sheet and rill erosion by water. The Arrowhawk project area "K" values for the soils were

determined using the NRCS Web Soil Survey. These values were generally in the low to moderate range for susceptibility to erosion. The erosion hazard increases to severe for these two soil associations when disturbance activities expose the soil surface. This rating is based on disturbing 50 to 75 percent of the soil surface, which is a very high percent of disturbance (NRCS 2011).

Environmental Consequences

The use of ground-based equipment for thinning trees and masticating brush, construction of skid trails, landings and temporary roads, and the use of prescribed fire can have impacts on soil and water quality. The direct and indirect effects of these actions can include soil disturbance and erosion, soil compaction, increased runoff, and sediment delivery to stream channels. Timber harvest activities have the potential to increase sediment delivery to streams from erosion and disturbance of stream channels. The risk of impacts to soil and water would be reduced through implementation of Best Management Practices (BMPs), which are described Proposed Action Design Features. The water and soils measures are designed to minimize soil disturbance and protect stream channels and riparian areas.

Direct and indirect effects from prescribed burning on soils and water quality can include loss of ground cover, increased erosion and runoff, increased water temperature and increased sediment delivery to stream channels (USDA 2005). The effects of fire on soil and water depend on fire severity and frequency, and on soil and site properties. Prescribed burns are designed to be low or moderate severity and generally burn in a mosaic pattern so that not all the vegetation is consumed. Riparian areas would be ignited on the outside edge so that the prescribed fire can back into the riparian vegetation towards the stream.

Pile burning can have a greater effect on soil fertility and soil biota than broadcast burning. Although the severe heating under the piles are damaging to the soil, only a small percentage of the total area may be affected (USDA 2005).

The use of livestock to remove cheatgrass and noxious weeds has the potential to degrade soil quality directly by trampling soils, and indirectly by consuming or trampling vegetation that otherwise protect soils. Soil compaction may reduce water infiltration and storage, physically restricts root growth, and reduces nutrient availability. The loss of vegetation results in bare ground, which subsequently is more susceptible to water and wind erosion.

No Action

The hazard of a stand replacing wildfire in conifer areas currently varies from low to very high, depending on the stand location and vegetation densities, condition and arrangement. In brush areas the fire hazard would continue to be elevated due to the tall, continuous, interlocking shrub canopy layer, which can carry a surface fire into the crowns of trees. High severity wildfires can remove much of the vegetation, along with duff and litter from the forest floor. Wildfires are usually more severe than prescribed fire and, as a result, they are more likely to produce significant effects on soil and water quality. Following wildfires, flood peak flows can increase substantially, affecting stream physical conditions, aquatic habitat and human health and safety (USDA 2005). Soil erosion would likely increase, along with streambank erosion from increased flows.

Proposed Action

The proposed action includes thinning trees using both ground based mechanized logging systems and aerial removal, masticating small trees and brush, prescribed underburning and pile burning, and sheep grazing to reduce cheatgrass and noxious weeds. These activities would take place over a number of years and could be done throughout most of the project area. Approximately 443 acres of the project area would be treated using ground based systems for thinning. Ground based yarding systems used for this project could include tractor yarding, mechanized equipment, horse yarding and commercial and personal use fuelwood. Ground based systems may require skid trails and landings, although no new permanent roads would be constructed. Skid trails and landings could impact about five percent of a treatment unit. Studies have shown that roads and skid trails are generally the main cause of erosion from logging (Megahan 1980). Best management practices (BMPs) would be implemented to reduce the potential effects to soil and water quality. Ground based thinning could result in soil disturbance and may have short term effects to soil and water quality. It is anticipated that in the long term water quality and soil quality would be maintained.

Effects to soil and water from masticating are generally minimal because the equipment operates over vegetation and leaves behind a layer of mulch. UC Davis and Integrated Environmental Restoration Services conducted a study on the West Shore of Lake Tahoe in 2004 to determine the effects of masticating equipment on soil compaction, runoff and erosion. The results of this study indicate that erosion effects from mastication are slight to insignificant when a layer of woodchip mulch is left on the ground surface. (Hatchett et al)

Prescribed fire, including both broadcast and pile burning, could occur on up to 3,500 acres, though it is likely that not all of this acreage would be suitable for burning. In addition, this burning would be spread out over a number of years. It is likely that some impacts to soil and water quality would occur from prescribed burning. Best management practices (BMPs) would be implemented to reduce the potential effects to soil and water quality. It is anticipated that in the long term water quality and soil quality would be maintained.

The use of sheep to reduce cheatgrass and noxious weeds could be utilized throughout much of the project area. Sheep would generally be used in the spring when the cheatgrass is beginning to green. The sheep would be moved through the area quickly to target consumption of cheatgrass and noxious weeds, but leaving native grasses. Potential impacts from sheep would be lessened by designating bedding areas away from streams and riparian areas and designating watering sites.

Cumulative Effects

Recreation is one of the primary uses of this area. There is a large network of non-motorized trails in the Thomas Creek, Whites Creek and Jones Creek watersheds. In addition there are roads that parallel both Thomas Creek and Whites Creek. These roads are a source of sediment. When the best management practices are implemented with the proposed action there would not be a noticeable increase in the amount of sediment in Thomas Creek or Whites Creek areas.

Vegetation

Affected Environment

The present forest developed under conditions unique to the last 160 years, which strongly influenced its structure and species composition. Early influences of logging, grazing, plentiful precipitation and suppression of wildfires played a strong role in shaping the vegetation that exists today. The current vegetation reflects the natural regeneration that followed the Comstock-era logging boom and subsequent fire suppression.

Cover types within the analysis area are mostly comprised of shrub areas, with conifer and aspen stands interspersed (Table 5). Shrub species also occur in the understory of the conifer, aspen and plantation areas. Within the analysis area, approximately 67 percent is shrub cover, 28 percent is conifer or mixed conifer cover, three percent is aspen, one percent is herbaceous cover, 0.5 percent is hardwood and less than 0.5 percent is urban or barren (USDA 2005).

Table 5 Arrowhawk Cover Types By Acre and Percent

Cover Type	Acres	Percentage of Total
Shrub	4,982	67%
Conifer	1,984	27%
Aspen	241	3%
Hardwood	36	0.5%
Herbaceous	79	1%
Mixed Conifer	60	1%
Urban	13	0.2%
Barren	3	<0.1%
Total	7.398	100%

The shrub vegetation in the analysis area is mostly comprised of sagebrush (*Artemisia sp*.), bitterbrush (*Purshia sp.),* and curl-leaf mountain mahogany (*Cercocarpus ledifolius*), with some rabbitbrush (C*hrysothmnus* sp.), manzanita (A*rctostaphylos sp.)* and ceanothus (*Ceanothus sp*.) species present.

The conifer vegetation is mostly comprised of Jeffrey pine (*Pinus jeffreyi*), white fir (*Abies concolor*) and mixed pine and fir. Incense cedar (*Calocedrus decurrens*) and lodgepole pine (*Pinus contorta*) also occur scattered throughout the area. Relative tree densities currently range from 44 to 99 percent of the maximum, with an average of 68 percent, this indicates that, on average, the conifer stands are self thinning through mortalitydue to high densities.

Current basal areas range from 113 to 243 square feet per acre and trees per acre range from 117 to 743, with most stands having large numbers of small diameter trees.

The quaking aspen (*Populus tremuloides*) in the analysis area occurs mostly as riparian aspen, though some upland aspen/conifer and meadow fringe aspen also exists. Riparian aspen communities are located along permanent or seasonal watercourses, meadow fringe aspen is similar to riparian aspen, but is situated along the edges of meadows and upland aspen occurs away from obvious surface moisture regimes (Shepperd et al 2006). The quaking aspen in the analysis area is also intermingled with cottonwood (*Populus sp*.), and conifer species. Approximately three percent of the analysis area is composed of aspen stands.

The hardwood cover is a small component, mostly comprised of willow (*salix sp.)* in the northern end of the analysis area and a very minor amount of riparian mixed hardwood in drainages. The herbaceous cover is mostly comprised of annual grasses and forbs, with a small amount of wet meadow. There is also a very minor (less than 0.2%) of barren and urban areas.

There is also approximately 190 acres of plantation in the analysis area, occurring within the conifer and shrub cover types. This area was planted with Jeffrey and ponderosa pine after the 1966 wildland fire. Some of the seed sources of these plantation trees is unknown and not from this general area. These “off-site” trees are showing signs of maladaption such as mortality, rounded crowns, and are also more susceptible to insects and disease. These off-site trees are not a natural component of this ecosystem and can potentially affect and/or displace natural components.

In 2009, stand examination was completed on approximately 700 acres within the conifer areas to collect fuels, vegetation, surface and topographic data. The stand examination data was analyzed using the Forest Vegetation Simulator (FVS) program (Dixon 2011). Trees per acre (TPA), square feet of basal area (BA) per acre, quadratic mean diameter (QMD), Stand Density Index (SDI), relative density and canopy closure were information utilized to complete the analysis. Basal area is the cross-sectional area of a single stem, including the bark, measured at 4 ½ feet above the ground. The QMD is the diameter of the average basal area per tree. SDI converts a stand’s current density into a density at a constant reference size of 10 inches dbh. The relative density is determined by dividing the stand density index (SDI) by the maximum SDI. SDI is a relative measure of stand density, as stand density increases so does density related mortality, insect and disease impacts. According to Tappeiner II et al (2007), the maximum SDI for ponderosa pine is 450. Jeffrey pine is similar to ponderosa pine and would share the same SDI. Some key relative densities include 25 percent which is when crown closure and the onset of competition begins; 35 percent which is when the stand is at the lower limit of full site occupancy and 60 percent which is the lower limit of self-thinning. When stands reach relative densities above 60 percent they grow and sequester carbon at increasingly slower rates as trees become stressed for resources such as soil nutrients, water and sunlight.

Environmental Consequences

No Action

Conifer Areas: The hazard of a stand replacing wildfire currently varies from low to very high, depending on the stand location, and vegetation densities, condition and arrangement. Mortality estimates for a high to severe wildland fire currently range between 10% and 97% of the stand lost. Without the occurrence of a wildland fire, the stand would still have a high hazard to bark beetle and density related mortality. Pine regeneration would depend upon the creation of natural gaps such as wind-throw or insect mortality pockets. The conifer stands range from 60 to 99 percent of the maximum stand density, indicating all the stands are self thinning and density related mortality currently is and would continue to occur at increasing levels. Stocking levels would remain high and stand vigor would continue to decline. Increases in overall stand diameters would continue to be minimal due to over-stocked conditions and minimal stand growth. Conversion of stands to more shade-tolerant species such as white fir would continue. Bark beetle related mortality would continue due to overstocked stand conditions. Carbon sequestration rates in stands that are near or above 60 percent relative density would continue to decrease.

Tree Plantation: The relative density of the plantation is currently 16 percent, which indicates there is no crown closure or on-set of competition; this is due to the previous treatments of the plantation. Competition between the trees would start to occur within approximately 20 years, when the relative density reaches 25 percent. The current canopy base height is approximately 2 feet, indicating the tree crowns are near to the ground. Due to this, the hazard of a wildland fire is very high, with a 98 percent mortality estimate. Shrubs would continue to re-establish themselves and provide additional ladder fuels. The existing off-site plantation trees would continue to occupy the site, producing cones and regeneration, further exasperating this non-local component.

Aspen Enhancement: Aspen stands would continue to decline in vigor and size and may eventually be replaced by conifer stands. Aspen are a disturbance species; without a major disturbance, such as fire or mechanical treatments, aspen suckering would not occur and the aspen stand would eventually die out. Aspen cannot regenerate in the shade produced by an established forest stand. For this reason, it can be replaced by shade-tolerant conifers, such as white fir, that become established under the shelter provided by the mature aspen stand. Other shade-intolerant conifer species, such as Jeffrey pine, also become established. If conifers continue to encroach upon the aspen community and aspen clones cannot sucker due to insufficient sunlight the existing clones would eventually die out and the stand would be replaced by a conifer community. Once an aspen stand is allowed to die due to lack of disturbance, establishment of new aspen from naturally occurring seed sources is extremely limited.

If a wildland fire were to occur aspen stands may be enhanced by the removal of invading conifer trees. However, with the high conifer densities within many of the stands, wildland fires may burn at such high intensities that the shallow aspen root structures may be destroyed and the stand lost.

Aspen stands would continue to be encroached upon by conifers and without a disturbance the aspen stands would eventually be lost, removing this ecologically important component.

Mastication and shrub and small trees thinning areas: Shrub densities would remain high, with a continuous, interlocking shrub canopy layer with little to no sprouting. The fire hazard would continue to be elevated due to the tall, continuous, interlocking shrub canopy layer, which can carry a surface fire into the crowns of trees. These dense shrub fields can also carry a fire between stands of timber and also out of the analysis area and into residential areas. In some shrub areas, scattered trees exist within the shrub fields; these trees are generally small, and have low heights to live crown. These trees would continue to have slower growth rates due to competition from shrubs and remain at an increased risk of loss due to wildland fire.

Animal Treatments: Cheatgrass and medusahead would continue to occupy sites at current densities, reducing quality forage and increasing the hazard of a fast moving fire.

Proposed Action

CONIFER AREAS: In treated areas, residual relative densities would generally range from 29 to 36 percent. In these areas, long-term sustainability of timber stands and resiliency to natural disturbances would improve and stand structures would be more representative of historic conditions. Tree species composition would change to reflect more historic conditions; white fir densities would be reduced and pine species such as Jeffrey and ponderosa would be increased. Tree stocking levels and fuel loading would be more consistent with pre-settlement fire regimes.

Natural disturbance regimes for forest insects, diseases, and fire in treated stands would be restored for approximately 20 to 30 years following treatment when stocking levels and fuels would increase to undesirable levels once again. Reducing tree stocking levels, adjusting tree species composition and maintaining the largest trees would help to restore more historic stand conditions.

Thinning from below would increase the average size of trees in treated stands following harvest; the majority of the large trees would be maintained in the treated areas. Generally, large trees would become more abundant in the future due to decreased mortality of existing trees and in-growth from younger trees. Thinning from below (also called low thinning) mimics mortality caused by inter-tree competition or surface fires and concentrates site growth potential on the dominant trees (Graham et al. 1999). Evans et al (2011) indicates that low thinning [thinning from below] is often used to remove ladder fuels and can also reduce canopy continuity and bulk density. Susceptibility to forest insects and diseases would be restored to endemic levels associated with historic stand conditions.

In treated areas, water availability may be increased. Bales et al (2011) indicates that preliminary estimates based on average climate information suggest that in the Sierra Nevada, treatments that would reduce forest cover by 40 percent of maximum levels across a watershed could increase water yields by about 9 percent. Residual trees in the treated areas

would have an increased height to live crown and decreased canopy bulk density, with a reduced risk of fire.

In areas where large numbers of trees greater than 30" dbh occur and the pockets of trees that are retained, relative densities would range from 46 to 99 percent. In these areas, density and insect related mortality would continue and long-term sustainability and resiliency to natural disturbances would not improve. White fir densities may also remain uncharacteristically high with an estimated 97% modeled mortality rate in a severe wildland fire.

Densities may also remain higher on 412 acres in the areas proposed for helicopter yarding, if this yarding method were not implemented and hand cutting and piling and burning were the only treatment method implemented.

In treated areas, trees with moderate to heavy western dwarf mistletoe infection would be reduced, as well as trees with western dwarf mistletoe "witches' brooms". Witches' brooms affect stand structure and tree flammability by lowering crown base heights and increasing the amount of flammable resin (Hoffman et al. 2007).

In the treated areas, there would be fewer trees per acre, with larger trees remaining with wider spacing. On the residual trees, the height to the live crown would be increased and the canopy bulk density would be decreased. This would provide for a reduced risk of fire.

Tree Plantation: Maintaining the low shrub densities and pruning would reduce shrub competition and also reduce the hazard of loss of the plantation due to wildland fire. Removal of off-site trees would allow for growth and establishment of native trees. Some of the more open areas would be planted with Jeffrey and/or ponderosa pine seedlings from local seed sources, providing for a sustainable forested area.

Aspen enhancement areas: In aspen stands where overstory and understory conifer removal occurs, an aspen suckering response is expected to occur within and around the aspen stand, allowing the aspen stand to expand and flourish. Competition for sunlight from conifers can be minimized by the elimination of the majority of the encroaching conifers from within and adjacent to the aspen stand. According the Shepperd et al (2006) removal of all overstory conifers is important to allow light to reach aspen roots and removal of conifers around the aspen stand for distance of approximately 1½ times the existing aspen height is optimal for aspen sprouting. Removal of conifers from within the stand would provide sunlight and nutrients to allow the aspen to successfully regenerate.

Soil compaction within the aspen stand during implementation would be reduced by using a feller buncher and preapproving skid trails. Reducing or removing conifer species would help to restore more historic aspen stand conditions by removal of competing conifers. In areas where only understory conifers are removed, alleviation of conifer competition may occur, but the proper growth environment for aspen would not occur (Shepperd et al 2006).

In areas where aspen stands are restored through removal of conifers, the fire risk would be reduced. It is usually difficult to get a fire to carry through a pure aspen stand, even in the understory. Because of this, aspen stands are often used as living fire breaks (Shepperd

2001). According to Shepperd et al (2006), where conifers are readily invading aspen sites, the natural fire cycle may be shortened, with fires occurring more frequently.

Aspen is a disturbance-dependant species; therefore maintenance would be needed to allow for continued existence of healthy aspen stands. Maintenance would depend on the residual conifer reproduction and would include either periodic underburning or hand removal of conifer regeneration.

Shrub and small trees thinning areas: Shrub regrowth would become more vigorous, sprouting younger, tenderer sprouts. These sprouts would provide more desirable forage for wildlife species. Due to the reduced densities, reduced overall shrub heights and no continuous fuel layer, the flame lengths and fire severity would be reduced. Thinning of the small diameter trees and release from the shrubs would eventually increase residual tree diameters and resistance to fire by eventually increasing the height to the live crown.

In masticated areas, the conifer height to live crown would be increased and the canopy bulk density would be decreased. In the areas that aren't burned, the total amount of fuel on the site would not be reduced; however it would re-distribute the ladder fuels to the forest floor. Prescribed burning in masticated areas when soils are moist would reduce damage to subsurface soils, beneficial soil organisms, and tree roots (JFSP 2011).

This treatment would be effective for approximately three to five years before shrub levels would begin to increase to undesirable levels. Maintenance every five to ten years would need to occur to maintain these areas. Maintenance may include mastication, piling and burning, seeding, and/or underburning.

Animal Treatments: Annual grasses reproduce by seed; therefore, invasive annual grasses can be suppressed when targeted consumption limits the production of viable seed. Seed heads of invasive grasses would be consumed while they are still green and unviable, in the early spring months. Early intense flash consumption (consumption for a short period of time) of these introduced grasses by domestic animals would remove biomass, decrease plant density and suppress flowering. Cheatgrass may require a second or third grazing in the spring because it can re-grow and produce new seed heads three to four weeks after the first defoliation. Domestic animals would readily consume cheatgrass and medusahead when it is green. Cheatgrass populations crash when cheatgrass plants do not produce viable seed for two or more successive years, leaving only scattered, thin populations. Domestic sheep and goats are especially effective because their consumption and movements can be closely controlled and they get a full bite of the grass more easily (Launchbaugh et al 2006). Once highly flammable cheatgrass is established, infrequent natural fires are supplanted by fires of far greater intensity that occur at intervals of only three to five years and can be catastrophically destructive to habitats and humans alike (USDA, RMRS 2008). Removal of invasive grasses such as cheatgrass and medusahead and replacement with native perennial grasses and shrubs would move this area towards a more historic vegetation structure and fire return interval. Cheatgrass has also been identified as the C3 species most positively responsive to increased CO_2 and thus capable of benefiting from global atmospheric trends (Ypsilantis et al 2003).

Cumulative Effects

Up to 43 percent of the conifer or mixed conifer cover type, 49 percent of the aspen cover type and 87 percent of the shrub cover type could be treated within the analysis area with this proposal.

Past and proposed treatments on private lands include hazardous fuels reduction projects, primarily mastication of brush. Treatments on public lands include commercial fuelwood removal, mountain mahogany thinning and mastication, plantation thinning, brush mastication, small tree and brush cutting, piling and burning, and personal use Christmas tree and fuelwood removal. These past treatments on private and public lands, along with the proposed action of this project would generally reduce stand densities, provide for a more resilient forest structure and landscape and move the watersheds toward desired conditions.

Visual Resources

The visual setting within and adjacent to the project area contains unique landscape features. The view shed within this project area contains many of the distinctive landscapes as seen throughout the Carson Ranger District. Mt. Rose, the Mt. Rose Wilderness, Whites and Jones Creeks, and Thomas Meadows just to name a few, comprise land features that draw visitors and residents to this area. Visitors enjoy the natural-appearing setting, with sagebrush flats in the valley, giving way to stands of Jeffrey and Ponderosa pine, aspen, white fir, and lodgepole pine with the rise in elevation and moisture. Fall colors, when the aspen leaves change, are a stunning experience. Management emphasis for visual characteristics within this project area is to retain the highest level of visual quality.

Environmental Consequences

No Action

Current visual quality would remain as it is if the No Action Alternative were selected. The project area contains some of the most unique scenery and visual characteristics on the entire district because of it setting adjacent to Reno and the major transportation corridors in the proximity to the project area. Without treatment, these characteristics would not be impacted, but the visual resource could be compromised if a catastrophic fire event occurred across the area.

Proposed Action

Effects to recreationists and homeowners from the proposed action include noise and visual impacts of equipment, both mechanical and motorized. Mowers, chainsaws, mastication equipment, and the assisting forestry vehicles would intrude upon the scenery experience, and would be bothersome to many who are camping, hiking, fishing or otherwise intending to be out in a natural setting. Slash piles, mastication trails and smoke would impact the scenery experience for many people.

Treatment activities such as mowing and piling must be timed carefully. Slash piles should not be left for long periods of time. Mowing must be accomplished so as to mimic natural

events that result in a characteristic landscape appearance (vegetation mosaics, differing heights and densities, etc.) Create no linear lines or extreme soil disturbance that creates color contrasts or other noticeable contrasts. Stumps must be low to the ground, screening associated with homes and recreation facilities must be maintained.

Cumulative Effects

There are no other projects planned in this area that would result in additional effects to the visual quality of the area.

Wildlife

FEDERALLY LISTED THREATENED OR ENDANGERED SPECIES

According to U.S. Fish and Wildlife Service species list obtained for the project area (Ref. No 2012-SL-0071), no Threatened, Endangered, or Proposed species have potential to occur in the project area.

FOREST SENSITIVE SPECIES

A Biological Evaluation (BE) was conducted for the Arrowhawk Fuels Reduction Project to analyze impacts to Region Four Forest Sensitive species which have potential to occur in the project area (project file). Based on this analysis, the following wildlife species were determined to potentially be impacted from the proposed action:

- Northern goshawk
- Flammulated owl
- White-headed woodpecker
- Mountain quail

Birds

A flammulated owl nesting territory occurs in the Thomas Creek area. Suitable habitat is also present for northern goshawk, white-headed woodpeckers, and mountain quail. Other Forest Service Sensitive bird species, including California spotted owl, great gray owl, and sage grouse, are not expected to occur in the project area due to the lack of late seral conifer stands and dense, continuous stands of sagebrush steppe that these species rely on. Bald eagles are not expected to occur in the project area due to the lack of a large waterbody within close proximity of the project area.

Mammals

Habitat for Forest sensitive mammal species is limited within the project area containing only marginal habitat for one species, the spotted bat, in the cliff areas along Thomas Creek which is not affected under the proposed action. The Arrowhawk area is a heavily used recreation area and is not considered suitable habitat for the reclusive wolverine. Habitat is

also not present for pygmy rabbit due to the lack of contiguous stands of sagebrush and appropriate soil type.

Amphibians

Potential habitat for the Sierra Nevada yellow-legged frog and the Yosemite toad is limited to private lands in the Thomas Creek area that would not be affected under the proposed action. Furthermore, the current and historic distribution of these species is well documented and does not include the project area.

MANAGEMENT INDICATOR SPECIES

Management indicator species (MIS) are identified in the Toiyabe National Forest Land and Resource Management Plan as representing a group of species having similar habitat requirements. MIS are not federally listed as threatened, endangered, or Forest Sensitive but has the potential to be affected by project activities. A review was conducted to determine: 1) if the project is within the range of any MIS, 2) if habitat is present within the proposed project area, and 3) if there are potential direct, indirect or cumulative effects on habitat components. MIS associated with habitats that may be affected by the project would be analyzed below.

The following MIS were selected for analysis for the Arrowhawk Fuels Reduction project:

- *Northern Goshawk *Accipiter gentilis*
- Yellow Warbler *Dendroica petechia*
- Yellow-Rumped Warbler *Dendroica coronata*
- Hairy Woodpecker *Picoides villosus*
- Williamson's Sapsucker *Sphyrapicus varius*
- *Sage Grouse *Centrocercus urophasianus*
- Mule Deer *Odocoileus hemionus*
- American Marten *Martes americana*
- Macroinvertebrates

*These species are also listed as Forest Sensitive

The following species were <u>not selected</u> for further analysis due to absence of habitat or *because the project will not directly or indirectly affect the habitat:*

- Palmer's Chipmunk *Eutamias spp.*
- Paiute Cutthroat Trout *Oncorhynchus clarki seleniris*
- Lahontan Cutthroat Trout *Oncorhynchus clarki henshawi*

OTHER SPECIES OF CONCERN CONSIDERED FOR ANALYSIS

- Mountain Beaver

Migratory Birds

SPECIES ACCOUNTS

Forest Sensitive Species

Flammulated Owl

Breeding populations of flammulated owls are found from central-southern British Columbia along the western United States to the Sierra Madre and mountain ranges of northern and central Mexico (Mika and Riddle 2006). In Nevada, Flammulated Owls have been documented during the breeding season in eleven mountain ranges including the Carson Range (Dunham et al. 1996). Flammulated Owls are listed as a sensitive species in four U.S. Forest Service Regions, including Nevada (Intermountain Region 4).

Flammulated owls prefer older forests and are often found in association with old growth yellow pine forests mixed with red fir, aspen, white fir, and incense cedar forest between 6,000 and 10,000 feet in elevation (McCallum 1994). Foraging habitat is generally more open understory and forest/grassland edge habitats (Heron et. al. 1985, McCallum 1994). In Nevada, flammulated owls breed in ponderosa pine, white fir, and limber pine with territory size ranging between 7 and 40 acres (McCallum 1994, GBBO 2010). Flammulated owls are secondary cavity nesters and prefer cavities excavated by northern flickers and pileated woodpeckers (Arsenault et al, 2002). Nests are usually placed three to 40 feet above ground (CDFG 1990).

Flammulated owls are migratory, wintering in Mexico and returning to the U.S. in late April to early May (McCallum 1994). Peak breeding months are June and July. The young fledge in late July and disperse by September. Flammulated owls forage almost exclusively on insects including mostly moths, beetles, and grasshoppers.

In 2008, individual flammulated owls were detected within Thomas Creek during surveys conducted by Forest Service personnel. In 2010, an active nest with two juvenile flammulated owls was discovered in this same area.

To protect flammulated owls and their habitat, a Protected Activity Center (PAC) was delineated following Sierra Nevada Forest Plan guidelines for the California spotted owl and northern goshawk (USDA 2004). The flammulated owl PAC protects the nest site and approximately 80 acres of the most suitable adjacent habitat that surrounds the nest area. The size of the PAC was based on the upper range of the known size of flammulated owl territories (~40 acres) and then doubled to provide a cautious protection zone for nesting and foraging. Under the Forest Plan, fuels treatments within PACs are modified to protect and/or improve the integrity of habitat conditions and are generally much less intensive than other areas.

Northern Goshawk (also MIS)

Northern goshawks have a holarctic distribution breeding from boreal Alaska and Canada south in to the East as far as Pennsylvania and New York and in the West to the mountains of

southern Arizona and New Mexico (Squires and Reynolds 1997). Nesting distribution on the Carson District ranges from north of Reno in the Dog Valley area, south to Spooner Summit and Genoa Peak and southwest throughout Alpine County including the Carson Iceberg Wilderness. Northern goshawks are year-round residents in neighboring Lake Tahoe Basin (Keane 1999) and are believed to be in the Carson Ranger District as well. Goshawks are a Forest Sensitive species throughout the Intermountain Region (Region 4).

Northern goshawks are typically associated with late seral or old growth forests, characterized by contiguous stands of large trees and large snags with closed canopies (53 to100%) and relatively open understory (Reynolds et al. 1992, Hayward and Escano 1989). On the Carson Ranger District, known goshawk nest sites are found in large aspens and conifers with an approximate average canopy cover of 55% to78 % (unpublished field data, on file Carson Ranger District). Foraging habitat requirements for goshawks are less understood than nesting habitat (Squires and Kennedy 2006). Results from some studies suggest goshawks forage in all forest types, but appear to select forests with a high density of large trees, greater canopy cover, high basal area and relatively open understories in which to hunt (Beier and Drennan 1997).

Patches of suitable habitat occurs within the upper portions of Thomas and Whites Creek where denser stands of conifer are present adjacent to streams. The riparian corridor along the upper portions of Jones Creek also contains small patches of dense canopy cover and multi-canopied structure that may provide suitable habitat for goshawks. Seven years of surveys have been conducted in Thomas and Whites Creek in 2002, 2003 and between 2006 and 2011 (USDA 2000). To date, no detections of goshawks have been recorded.

Mountain Quail

Nevada is considered to be on the periphery of the mountain quail's range (NDOW 2012). Mountain quail are known to occur throughout the Carson Ranger District, usually at elevations above 5,000 feet. Mountain quail are listed as a Forest Service Sensitive species in the Intermountain, Pacific Southwest and Northwest Regions.

In the Sierra Nevada, mountain quail were found nesting and foraging in mixed conifer stands that were mixed with montane chaparral brush communities composed of chinquapin, snowbrush, and Greenleaf manzanita (Terres 1980, Pope 1999). Mean shrub cover requirements are approximately 51% with a mean shrub height of approximately 6.0 feet (Brennan et al. 1987). Mountain quail can also be opportunistic nesters utilizing a wide variety of habitat types for breeding.

Suitable habitat for mountain quail occurs in the upper reaches of Whites and Thomas Creek on north facing slopes, near the creeks where dense stands of mahogany and other brush species are present. Mountain quail have not been detected in the project area during Forest Service wildlife surveys.

White-Headed Woodpecker

The white-headed woodpecker occupies a restricted range from British Columbia, north central Washington, northern Idaho south through Oregon, east of the Cascades, to southern California and west-central Nevada (Johnsgard 1973). White-headed woodpeckers are year round residents on the Carson Ranger District and are considered Sensitive Species in the Intermountain and northern regions of U.S. Forest Service.

White-headed woodpeckers preferred habitat appears to be ponderosa pine stands with large diameter trees, soft snags averaging 23 inches dbh, and 40 to 70 percent canopy cover. between 4,000 and 9,000 feet elevation. White-headed woodpeckers occur more often in old growth conifer stands and are often absent in second growth stands (Dixon 1995). White-headed woodpeckers are also found in open-canopied conifer stands where large diameter trees and snags are present and alongside streams (Cornell 2012). White headed woodpeckers are tolerant of human activity in nest vicinity as long as activity does not involve nest tree; birds become extremely agitated if nest itself is disturbed (Garrett et al 1996). They are also tolerant of humans near roost as long as human activity is not prolonged (Ibid).

Management Indicator Species

Yellow Warbler

Yellow warblers breed in the Sierra Nevada and are uncommon to common summer residents on the Toiyabe National Forest (Finch 1991). According to USGS Breeding Bird Survey information, population trends of yellow warblers in the Sierra Nevada have decreased significantly between 1966 and 2009 (Sauer et al 2011).

Yellow warblers are closely tied to riparian habitats that contain willow, alder, and elderberry components. Although yellow warblers can be found in mixed conifer habitat, they are usually migrants (not breeders) associated with riparian areas found at the edge of conifer stands and or conifer stands that contain substantial amounts of brush (Zeiner, et al. 1990).

Habitat destruction and brown-headed cowbird parasitism are the biggest threats to yellow warblers (Erlich et al. 1988). Portions of the Arrowhawk project area contain riparian vegetation suitable for yellow warblers such as willow, alder and bitter cherry.

Yellow Rumped Warbler

According to USGS Breeding Bird Survey information, population trends of yellow-rumped warblers in the Sierra Nevada have been stable and increasing between 1966 and 2009 (Sauer et al 2011).

The yellow-rumped warbler is considered highly adaptable and can be found in a variety of habitats including coniferous forest, mixed woodlands, deciduous forest, pine plantations, bogs, forest edges, and openings (Sibley 2000). Populations of yellow-rumped warblers are

stable or increasing in most areas (Cornell 2012). Yellow-rumped warblers are primarily insectivores but also depend on berries in the winter.

Within the Arrowhawk project area, yellow-rumped warblers would likely be found in the mixed conifers stands present throughout the area. Migratory bird surveys were conducted in three main habitat types (aspen montane chaparral and mixed conifer) within the project area during 2008, 2009, and 2010. A total of four yellow-rumped warblers were detected during these surveys.

Hairy Woodpecker

Hairy woodpeckers occur throughout most of the continental United States. Hairy woodpeckers are considered widespread and common (Cornell 2012)

Hairy woodpeckers are associated with deciduous and coniferous woodlands found throughout North America (Ryser 1985, Erlich et. al 1988). In the Sierra Nevada, hairy woodpeckers nest in low to moderate canopy closure (< 70%) containing trees with a minimum diameter of 25 cm and minimum height of 4.6 meters (Sousa 1987). The hairy woodpecker requires cavities for nesting and foraging and feeds primarily on wood boring insects and insect larvae. Hairy woodpeckers are considered opportunistic foragers and will feed from a variety of substrates including snags and downed logs (Sousa 1987).

The flammulated owl PAC likely contains some of the highest quality habitat for hairy woodpeckers due to the relatively high abundance of large diameter snags and live trees in the area. Portions of the aspen stands also provide suitable habitat for this species. Migratory bird surveys were conducted in three main habitat types (aspen montane chaparral and mixed conifer) within the project area during 2008, 2009, and 2010. A total of two hairy woodpeckers were detected during these surveys.

Williamson's Sapsucker

Williamson's sapsuckers are found along the entire length of the Sierra Nevada and are considered a year-round resident on the Toiyabe National Forest (Finch 1991).

This sapsucker breeds at middle to high elevations, generally from 4,900–10,500 feet in montane mixed deciduous-coniferous forest with quaking aspen as an important nesting substrate. Williamson's Sapsucker is somewhat unusual in that it is tightly tied to aspen stands for nesting and coniferous forests for foraging. In western and southern Nevada, Williamson's Sapsuckers occur year-round (GBBO 2010). Availability of dead trees or live trees with heartwood rot is a critical component of breeding habitat. Williamson's Sapsucker nests are located in fairly large snags (1 – 2.5 ft in diameter) (GBBO 2010). If large snags are preserved, the species appears to be fairly tolerant of habitat disturbances and may even respond to forest fires with population increases, if additional large snags are created in the process and at least some live trees remain for forage. The USGS Breeding Bird survey reports population trends of Williamson's sapsuckers in the Sierra Nevada have been stable from 1966 to 2009 (Sauer et al., 2011).

The flammulated owl PAC area likely contains the highest quality habitat for Williamson's sapsuckers due to the relatively high abundance of large diameter snags and live trees in the area. Portions of aspen stands in the project area also provide suitable habitat for this species. Migratory bird surveys conducted during 2008, 2009, and 2010 resulted in no detections of Williamson's sapsuckers within the project area.

Sage grouse (also Forest Sensitive)

Core populations of sage grouse occur in Colorado, Idaho, Montana, Nevada, Oregon, and Wyoming with remnant populations occurring in other states including California (Neel 2001). On the Carson Ranger District, only scattered numbers of sage grouse are known to occur and only in Alpine County, California at the southern end of the District. As part of the Nevada Governor's Sage Grouse Conservation Strategy (Ibid), Population Management Units (PMU) were delineated to describe occupied habitat for sage grouse throughout the state of Nevada.

Sage grouse are largely dependent upon sagebrush ecosystems for both foraging and breeding. Breeding sites, or "leks" are usually situated on ridge tops or grassy areas surrounded by a substantial brush and herbaceous component (Schroeder et al 1999). Nesting habitat for sage grouse is characterized primarily by Wyoming big sagebrush communities that have 15 to 38 percent canopy cover and a grass and forb understory (Terres 1980). Dense sagebrush cover is important to nesting success of sage grouse (Connelly et al 2000). Summer and dispersal habitat consists of sagebrush mixed with areas of wet meadows, riparian, or irrigated fields.

Sage grouse are not known to occur in the project area currently or in historically. The majority of brush stands in the area are dominated by manzanita and ceonothus and do not contain contiguous stands of sage brush. The project area is not within or adjacent to a PMU.

Mule Deer

The Arrowhawk project area is occupied primarily by the Loyalton-Truckee Interstate herd. A 2010-2011 status report prepared by the Nevada Department of Wildlife (NDOW) for this area stated that while populations appear static in the short term, the overall trend for this herd is declining (Cox et al 2011).

The project area contains approximately 1200 acres of winter range for mule deer located along the lower portions of the project area, just west of Timberline Road. The remainder of the project area is likely used by mule deer as transitional habitat between critical winter range in the lower elevations and critical summer/fawning range in the Mt. Rose area. Range for mule deer is generally considered "critical" when habitat components meet or exceed the biological requirements necessary to sustain a viable population of mule deer. For example, critical summer habitat is typically at higher elevations where temperatures are cool and adequate stands of brush and trees provide thermal and protective cover for newborn fawns

(NDOW 2004). Critical winter range is found at lower elevations where brush stands remain snow free and readily accessible for browsing and cover.

The Loyalton-Truckee herd has endured substantial declines over the last decade largely due to loss of habitat from urban development, wildfires, and increased recreation (Cox et al 2011). Currently, the Loyalton-Truckee deer herd deer is continuing to decline.

Mule deer occur throughout the project area.

American marten

In California, marten occur in the northern Sierra Nevada at elevations of 3,400 feet to 10,400 feet, averaging 6,600 feet (USDA 2001). On the Carson Ranger District, marten have been detected on Slide Mountain near the Mount Rose Ski Resort and in Hope Valley, Alpine County, California.

Preferred habitat for denning and resting is characterized by dense (60 to 100% canopy), multi storied, multi species late seral coniferous forests with a high number of large (> 24 inch dbh) snags and downed logs (Freel 1991). These areas are generally in close proximity to both dense riparian corridors (used as travelways), and include an interspersion of small (<1 acre) openings with good ground cover(Ibid). Marten use rest sites daily and therefore availability of these sites in suitable habitat is critical to their well being (Martin and Barrett 1991). Marten prey items vary seasonally feeding primarily on ground squirrels and chipmunks during spring through fall and squirrels, mice, and snowshoe hares in the winter (Zielinski et al. 1983). Alterations to marten habitat are their greatest threat and may even promote local extinctions (Lacy and Clark 1993).

High quality habitat for martens exists within the flammulated owl PAC portion of the project area. This area contains high structural diversity and dense canopy cover, preferred by marten. Adjacent pockets of dense conifer may also provide some habitat for marten. Furbearer surveys were conducted in within the project area during the fall of 2011. Survey sites were randomly selected in the project area following methods described in Zielinski et al (1995**)** using baited camera stations**.** No detections of martens were recorded.

Macroinvertebrates

Freshwater benthic macroinvertebrates, are animals without backbones that are larger than ½ millimeter (the size of a pencil dot). These animals live on rocks, logs, sediment, debris, and aquatic plants during some period in their life. They include crustaceans such as crayfish, clams and snails, aquatic worms and the immature forms of aquatic insects such as stonefly and mayfly nymphs. Macroinvertebrates are an important part of the food chain, especially for fish. Many feed on algae and bacteria, which are on the lower end of the food chain. Some shred and eat leaves and other organic matter that enters the water. Because of their abundance and position as "middleman" in the aquatic food chain, macroinvertebrates play a critical role in the natural flow of energy and nutrients. Macroinvertebrates are likely present in the three main perennial creeks found in the project area, Thomas, Whites, and Jones Creek.

Other Species Considered

Mountain Beaver

The mountain beaver is found in moist environments with moderate to dense vegetation and appear to be restricted to riparian areas in the relatively xeric Sierra Nevada (Beier 1989). Mountain beavers are generally solitary animals and spend most of their time below ground in shallow, extensive tunnel systems. Mountain beavers are active throughout the year and are generally nocturnal home range for the mountain beaver is relatively small with most activity occurring within 24 m (80 ft) of nest (Neal and Borrecco 1981).

A large mountain beaver colony was discovered in the upper reaches of Thomas Creek in 2009. This area is located approximately .25 miles outside of the project area.

Neotropical migratory birds

The migratory songbirds found in North America include roughly 350 species, of which about 250 are known as “neotropical migrants”. Migratory birds spend their winters in the tropics of southern Mexico, Central and South America, and the West Indies. Migratory songbirds can be found in virtually every habitat on the continent, and usually half or more of the breeding birds in any sampled area are migratory (Robinson 1997).

A wide variety of habitat types occur within the project area hosting a similarly wide array of migratory and resident birds. Of these habitat types, aspen-riparian is considered the “highest priority” habitat for Neotropical Migratory birds (NTMB) in the 1999 Draft Avian Conservation Plan for the Sierra Nevada Bioregion (Siegel and DeSante 1999). Aspen-riparian habitats support an extremely rich and abundant avian community that includes several species of conservation concern, such as warbling vireo and red-breasted Sapsucker (Gardali et al. 2000). Other habitats in the project area, including late successional forest, are also ranked as high priority and support species such as brown creeper and golden-crowned kinglet Appendix A. A priority Species table including trend information calculated from the Breeding Bird Survey (BBS) is located in Table 7.

Migratory bird point count surveys were conducted within the Arrowhawk project area during 2008, 2009, and 2010. Surveys were conducted following the Great Basin Bird Observatory Protocol (GBBO 2003) and included counting all identifiable species of birds along a 100 meter transect within three main specific habitat types, aspen, riparian and conifer.

The two largest threats to migratory birds are habitat fragmentation on breeding grounds and deforestation of wintering habitat (Finch 1991). Compared to other birds, migratory species are the most negatively affected by fragmentation, and are usually absent from small or highly isolated forests (SERC 2003).

Table 6 Neotropical Migratory Birds Which May Use The Project Area		
Species	**# Present**	**BBS Trend**
Brown-headed cowbird	4	decreasing significantly
California quail	30	increasing significantly
Cassin's vireo	4	increasing significantly
Chipping sparrow	7	decreasing significantly
Common raven	4	increasing significantly
Dark-eyed junco	18	stable
Dusky flycatcher	2	stable
MacGillivary's warbler	9	stable
Mountain chickadee	21	decreasing significantly
Mourning dove	8	stable
Northern flicker	3	stable
Olive-sided flycatcher	7	decreasing significantly
Spotted towhee	3	stable
Stellar's jay	35	stable
White-breasted nuthatch	2	stable
Western tanager	17	stable

ENVIRONMENTAL CONSEQUENCES

NO ACTION

T & E, Forest Sensitive, MIS, and Other Species of Concern

In the long term the most likely consequence of the no action alternative would be habitat destruction by a severe stand replacing fire. Fires similar to the Martis fire in 2001 and the Waterfall fire in 2004 have been stand replacing fires that leave very little habitat for wildlife and plants. Although implementation of this project does not guarantee such a fire still won't occur, fuels treatments would lower the risk by reducing fuel loading throughout the project area. In the short term under the no action alternative, habitat would continue to be available for animals that exist within the project area. Natural disturbance such as drought, mistletoe, and insects would continue to occur and potentially benefit wildlife by providing snags and natural openings within dense conifer stands.

In areas that lack natural disturbance, the brush and forested stands would continue to become denser, lowering habitat quality for goshawks, flammulated owls, white-headed woodpeckers, and other wildlife species, while elevating the risk of losing the entire area to catastrophic wildfire. Aspen stands, which are considered one of the most important habitat types for a variety of plant and animal species, would continue to decline in vigor and health due to increased encroachment from conifers.

PROPOSED ACTION

Forest Sensitive Species

Northern goshawk (also MIS)

Portions of the project area contain suitable habitat for goshawks, particularly in the upper reaches of Thomas, Whites and Jones Creek where denser stands of conifer are present. Multiple years of surveys in the project area and surrounding suitable habitat have resulted in no detections of goshawks.

Because goshawks are not known to occur in the area, no direct impacts to goshawks from project activities are expected to occur.

Although goshawks are not known to currently occur in the area, alterations to habitat may indirectly impact potential future nesting opportunities by goshawks. For example, changes to structural diversity in a stand (reduction in canopy layers, down woody debris, snags) may indirectly impact goshawks by affecting prey populations (Kennedy 2003, Reynolds et al, 1982). When over-harvesting of dead trees (snags) occurs, habitat for prey species such as woodpeckers, songbirds, and small mammals that rely on snags for nesting and foraging, may become limited. Carey et al. (1992) showed that squirrel populations were more abundant and remained at relatively constant levels in old growth forests where snags and down wood were present in comparison to managed second growth stands. A decrease in

canopy may also reduce protective cover components required by goshawks for both thermal regulation and predator protection while nesting.

To maintain habitat for goshawks and other late-seral related species, the following design features have been incorporated into the proposed action:

- Pockets of trees up to 1. 5 acres would be retained in specified areas where canopy cover currently exceeds 50%, and large down woody debris and larger diameter snags exist. Primarily this includes areas near drainages where denser canopy tends to occur, but also includes denser patches upland Some thinning of trees across diameter ranges less than 18" dbh may occur within these pockets; however canopy closure would not be reduced below 50 percent and the goal would be to maintain vertical and horizontal structure within the stand.
- In units where canopy cover is less than 50 percent, clumps of smaller diameter trees would be retained near trees with a diameter of 18 inches or greater and canopy cover would be retained at 40 percent or greater (where feasible).
- Goshawks rely on many types of migratory birds for prey. To help reduce potential impacts to migratory birds, project activities would not occur in aspen stands and riparian areas April through July to minimize disturbance during the critical breeding period.
- Outside the defense zones , three of the largest snags per acre would be retained. Large woody debris on the ground would also be retained, at least three pieces per acre, greater than 12" dbh or the largest available. This design feature also helps protect habitat for goshawk prey such as songbirds and small mammals.

Cumulative impacts

Because goshawk are not known to occur in the project area and because of the design features incorporated into the proposed action to protect potential goshawk habitat there would be no cumulative effects to goshawk form this proposed action.

Determination: Based on the above assessment, it is my determination that the proposed project may impact some habitat potential for goshawks but would not lead to a trend toward federal listing or a loss of viability.

Mountain quail

Suitable habitat for mountain quail occurs in the upper reaches of Whites and Thomas Creek on north facing slopes, near the creeks where dense stands of mahogany and other brush species are mixed with conifer and aspen. Mountain quail have not been detected in the project area during Forest Service wildlife surveys.

Conifer Stands:

Under the proposed action, activities associated with the removal of conifer and/or shrubs may directly impact mountain quail by flushing birds from nesting and/or foraging sites. Inadvertent trampling of nest sites may occur from heavy equipment causing mortality of

eggs and/or young birds. Adults nesting in the area may permanently abandon nest sites if the disturbance is too severe and/or ongoing. However, under the proposed action, no project activities would occur in riparian areas until after July. This would reduce potential disturbance to nesting as mountain quail are more likely to nest near riparian areas and have typically completed their breeding cycle by mid-July. Direct impacts to mountain quail following the breeding season are also expected to be minimal and short term. Both adults and juvenile mountain quail are flight capable during this time period and would be able to disperse to adjacent suitable habitat during project activities.

Indirect impacts to mountain quail from the proposed action are expected to be minor and short term. Reductions in canopy cover, particularly reductions in understory canopy layers areas may result in a decrease of available cover for mountain quail within the project area. Loss of cover habitat may increase predation or may compromise thermo-regulation for mountain quail causing them to overheat and/or become too cold during extreme weather conditions. However, impacts to cover habitat would be partially offset by improved foraging conditions as regeneration of forbs and grasses are expected following project treatments. Design features such as retaining pockets of more structurally diverse stands along riparian corridors would help maintain habitat for mountain quail. Similarly, brush treatments would be conducted in a mosaic pattern, leaving large patches of brush untreated and available as cover for mountain quail. Suitable cover is also located adjacent to the project area and would provide adequate refuge for mountain quail until the site has recovered.

Aspen Stands:

Under the proposed action, approximately 118 acres of aspen stands would be enhanced by removing live conifers up to 1 ½ times the existing aspen tree height. Direct impacts to mountain quail include displacing mountain quail from foraging and/or nesting areas due to noise and disruption from aspen treatment activities (conifer removal). However, design features associated with the proposed action would help minimize impacts to mountain quail. For example, treatment in aspen stands would not occur between April and July which avoids much of the critical breeding period for mountain quail. Juvenile mountain quail typically fledge between late June and July and would therefore be able to disperse to adjacent habitat during project operations. Foraging opportunities could also be disrupted resulting in mountain quail foraging in adjacent habitat during project activities. However, this disruption would be temporary and is not expected to have any long-term negative impacts to mountain quail.

Under the proposed action, conifer would be removed from within and adjacent to aspens stands, temporarily reducing overstory canopy cover within the stand. Reductions in overstory canopy cover would likely have minimal impacts on habitat for mountain quail as quail are more dependent on mid and lower level canopies, such as brush and small trees for protective cover. Under the proposed action, minor removal of understory vegetation in the aspen stands is expected to occur. However, regeneration of robust and biologically diverse forbs and grasses are expected to occur as early as the following spring and would therefore provide improved foraging habitat for mountain quail over the long term. The reduction in understory vegetation may also slightly increase the potential for mountain quail to be

exposed to predators. However, much of the understory vegetation in the aspen stands will be retained and the abundance of suitable cover adjacent to the project area would provide adequate refuge for mountain quail until the site has recovered. Therefore, indirect impacts to mountain quail from the proposed action are expected to be minor and short term.

Prescribed Burning:

The majority of prescribed burning would occur in the fall, winter, or early spring. Prescribed burning during the spring months could potentially impact nest sites and affect nesting success for the season. Adults, eggs, and/or nestlings could also potentially be injured or killed from fire and/or smoke inhalation. However, prescribed burning would be applied as a low intensity burn that would be slow moving and creep in the understory. Under this prescription, although some nest sites may be lost to fire, most of the adult mountain quail would have the ability to escape the site to undisturbed adjacent habitat. Furthermore, under the proposed action, spring prescribed burning sites would be surveyed prior to burning and all active nests would be flagged and avoided.

Cumulative impacts

Catastrophic wildfires and encroachment of urban development has lead to the loss of mountain quail habitat along the Front Range. Many burned areas have been replaced by invasive species that out-compete native vegetation and provide no forage or cover value for mountain quail. In order to restore habitat in these burned areas, the Forest Service, as well as other local governments and non-profit groups, are currently implementing several native plant restoration projects in order to improve habitat in these areas. For example, the Forest Service recently planted several thousand Jeffrey pine and mahogany seedlings in the 2007 Hawken Fire area just north of the Arrowhawk project area. To control medusahead and other invasive species, Washoe County has conducted aerial applications of herbicide followed by seeding of grassed and forbs to restore burned sites in the local area. These restoration efforts would eventually improve habitat conditions for mountain quail. The short term impacts to mountain quail habitat resulting from this proposed action would not result in a incremental decline in the available habitat.

Determination: Based on the above assessment, it is my determination the project may impact individual mountain quail but would not lead to a trend toward federal listing or a loss of viability.

Flammulated owl

In addition to the 80 acre designated PAC, suitable habitat for flammulated owls also occurs in portions of Whites Creek and Jones Creek as well. Surveys conducted in these areas have resulted in no detections of flammulated owls.

Designated Flammulated Owl PAC Area:

Within the PAC, disturbance to breeding flammulated owls is expected to be minimal. Under the Proposed Action, only hand thinning of small diameter trees and brush would occur in areas where such treatments would improve habitat conditions for flammulated

owls. For example, thinning "dog-hair" thickets of small diameter trees would improve maneuverability and foraging capability for flammulated owls within the PAC. Thinning small patches of decadent brush would also allow for growth of new vegetation in the understory, possibly improving prey populations for flammulated owls (insects). The reduction in fuel loading would also help minimize the intensity of a potential fire and protect important habitat for flammulated owls. All snags, down woody debris and other important habitat features would be retained within the PAC. No project activities within the PAC would occur during the Limited Operating Period (May14- September 15) to minimize disturbance to nesting owls.

Potential Habitat Outside of PAC

Although flammulated owls are not known to nest in other portions of the project area, suitable habitat may be used by individual flammulated owls for foraging, dispersal or other activities.

Conifer Stands:

Direct Impacts: Design features associated with the Proposed Action would reduce potential direct impacts to flammulated owls. For example, wildlife pockets would be retained along all of the riparian corridors where the most suitable habitat for flammulated owls occurs (outside of the PAC). Pockets would retain large diameter trees and snags as well as preserve smaller trees in the understory to maintain structural integrity. Furthermore, project activities in the riparian areas would not occur between April and July which is after the breeding season for flammulated owls. Direct impacts to flammulated owls may result from thinning operations adjacent to these habitat pockets. Noise from equipment and other activities may flush flammulated owls from foraging areas. However, any disturbance is expected to be minor and short term as flammulated owls typically forage at night when project activities would not be occurring. In addition, flammulated owls appear to be very tolerant of human disturbance (McCallum 1994) and therefore temporary disruptions would not result in any long term impacts to the owls. Adjacent undisturbed habitat would also provide sufficient foraging habitat for adults to temporarily disperse to during project operations.

The greatest immediate risk to the flammulated owl is loss of critical nesting, security, and foraging habitat features including grass and shrub components of foraging and snags for nesting. Under the proposed action, approximately 878 acres of conifer forest would be thinned using ground based and helicopter logging systems. Within this area, trees up to 24" dbh would be removed with an average target basal area of 90 square feet. In some areas, this would result in less than half of the existing basal area being retained. Reductions in stand density and canopy cover may displace flammulated owls from traditional foraging and/or roosting sites. However, under the Proposed Action pockets of high quality habitat along densely wooded riparian corridors would be retained. Pockets would retain large diameter trees and snags as well as preserve smaller trees in the understory to maintain structural integrity. Wildlife pockets would likely encompass approximately 80 of the 878 acres proposed for thinning. While this is a relatively small percentage of the overall project area,

the wildlife pockets would be retained within suitable habitat for flammulated owls thereby minimizing potential impacts.

Flammulated owls may occasionally use the remainder of the project area for foraging and/ or traversing outside of the breeding season. In general, treatment proposed for these areas would result in more open stands with less understory vegetation. Stand densities would be reduced by as much as 50 to 70 percent in some units from the existing levels. In the short term, changes in canopy cover and stand densities within the project area may impact flammulated owls by reducing thermal and protective cover. Over the long term, however, the more open sites may improve foraging conditions for flammulated owls, where they occur adjacent to denser stands of conifer. Under the proposed action, trees targeted for removal would be the smaller diameter trees that are competing with mature overstory trees with the average size of tree harvested estimated at 12" dbh. To retain adequate foraging and dispersal habitat adjacent to the PAC, clumps of three to five trees at least 18" dbh would be retained every acre. If possible, canopy closure within the entire unit would not be reduced below 40 percent, This design feature, in addition to wildlife pockets of stands outside of the PACs, would help maintain adequate structure and canopy cover to continue to support foraging and dispersing flammulated owls in the project area. Other design features, including retaining three of the largest snags per acre and large down woody debris, would continue to provide structural integrity of habitat for flammulated owls.

Aspen Stands*:*

Under the proposed action, approximately 118 acres of aspen stands would be treated by removing live conifers up to 1 ½ times the existing aspen tree height. Removal of conifers would require the use of heavy equipment such as feller-bunchers. Direct impacts to flammulated owls include noise disturbance and displacement from tree removal activities. However, design features associated with the proposed action would help minimize impacts to flammulated owls. For example, treatment in aspen stands would not occur between April and July which is considered the typical breeding period for flammulated owls. Juvenile owls typically fledge between late June and July and would therefore be able to disperse to adjacent habitat during project operations. In addition, under the proposed action, only live conifers would be removed leaving snags in place to provide protection for flammulated owls.

Removal of conifer may impact flammulated owl habitat by temporarily reducing canopy cover and some structure within the stand. Reduction in cover may limit nesting opportunities for flammulated owls while the aspen stands recover. Over the long-term, however, aspen stand improvements would ultimately benefit flammulated owls. Aspen stands are considered to be one of the most biologically diverse vegetation communities in the world and are often used by flammulated owls for nesting and foraging. The abundance of vegetation and relatively high moisture conditions in aspen stands tend to produce an abundance of insects, including moths, which are the primary diet of flammulated owls. Therefore, improvements to aspen stands would likely result in an increased food source for flammulated owls. Snags would be retained in the aspens stands as well as large, down woody debris which would also help maintain structure within aspen habitat for flammulated owls.

Prescribed Burning:

Prescribed burning would also be conducted within the project area (outside of the PACS). Flammulated owls, particularly juveniles, may be impacted from smoke associated with prescribed burning. Areas of heavy smoke concentrations may impede lung development and the ability for flammulated owls to breathe. Because this activity is primarily occurring outside of any expected breeding area, impacts from prescribed burning would be minimal as flammulated owls would be able to disperse to adjacent areas not being burned and avoid the smokiest areas. Prescribed burning may result in some loss of down woody debris and understory vegetation which may impact foraging habitat for flammulated owls. However, design features associated with the proposed action, including retaining large diameter down woody debris and excluding prescribed burning in the PACS would minimize these impacts. Prescribed burning would reduce fuel loading in the project area and therefore reduce the potential for loss of habitat from a catastrophic wildfire.

Cumulative Impacts

As mentioned above, the greatest risk to flammulated owls is loss of habitat including snags, down woody debris and shrubby vegetation. Loss of snags in late-seral habitat is especially detrimental to nesting success of flammulated owls (USDA 2001). The Arrowhawk/Mt Rose area has been intensively managed in the past, prior to and after National Forest System acquisition in 1939. Large scale logging occurred in the 1850's and throughout the first part of this century where Comstock logging operations essentially denuded the landscape of conifer species. In more recent years, commercial and residential development has occurred in the area, fragmenting conifer stands and other vegetation communities. Within and adjacent to the analysis area, several fuels reduction projects have occurred both on private and public lands that have likely had some impacts to flammulated owls. Projects, such as North Washoe Fuels Reduction, reduced canopy cover by half and thinned trees to an average of 60 to 80 square foot basal area. Other projects surrounding private residences have also removed trees and other vegetation that may have resulted in reduced habitat availability for flammulated owls. However, fuels reduction projects proposed and implemented throughout the District, including the Arrowhawk Fuels Project, would also help lower the potential for a catastrophic stand replacing wildfires that could completely eliminate habitat in localized areas.

For example, in 2007, the Hawken fire burned approximately 3000 acres of timber and brush along the Sierra front. It is not known if any flammulated owl territories were lost as a result of this fire, but potential habitat for this species was likely reduced. Natural regeneration and Forest Service reforestation efforts are expected to help restore some of this habitat in the long term. Standing snags resulting from the fires may also help improve potential nesting habitat for flammulated owls, particularly in those areas where snags are surrounded by large patches of live, intact trees.

Determination: Under the Proposed Action, some impacts to flammulated owls, including human disturbance and reduction in available habitat, are expected to occur. However, these impacts would be temporary and offset by improved habitat conditions in some portions of the project area following treatment activities. Based on the above assessment, it is my

determination the project may impact individual flammulated owls but would not lead to a trend toward federal listing or a loss of viability.

White-headed woodpecker

Suitable habitat for white-headed woodpeckers overlaps with other late seral species in that they require relatively dense canopy cover with an abundance of large diameter dead and live trees. Therefore, it is assumed that the highest quality habitat for white-headed woodpeckers within the project area occurs within the 80 acres of the designated flammulated owl PAC in Thomas Creek. Larger aspen stands and pockets of larger trees located along Thomas, Whites, and Jones Creeks also provide habitat for white-headed woodpecker.

Designated White-headed woodpecker Owl PAC Area:

Within the PAC area, disturbance to white-headed woodpeckers is expected to be minimal. Treatment within PACS would consist of thinning "dog-hair" thickets of small diameter trees that are currently considered unsuitable for white-headed woodpeckers due to the density of the stands. The small diameter tree thinning within the PAC would not impact any potential nest sites and would occur well outside of the breeding period for white-headed woodpeckers. Minor thinning of these stands would improve the overall conditions of the stand and reduce the threat of a catastrophic wildfire and resulting loss of habitat for white-headed woodpeckers.

Potential Habitat Outside of PAC:

Conifer Stands:

Direct impacts to white-headed woodpeckers in and near conifer treatment areas may result from thinning operations such as timber removal and mastication. Noise from equipment and other activities may flush white-headed woodpeckers from foraging areas. However, white-headed woodpeckers appear to be tolerant of human disturbance and therefore temporary disruptions are not likely to result in any long term impacts. Design features, including retention of wildlife pockets along riparian corridors, would minimize disturbance to white-headed woodpeckers. Pockets would retain large diameter trees and snags as well as preserve smaller trees in the understory to maintain structural integrity. Furthermore, project activities would not occur between April and July which is after the breeding season for white-headed woodpeckers.

In addition, adjacent undisturbed habitat would also provide sufficient foraging habitat for adults to temporarily disperse to during project operations. Juvenile white-headed woodpeckers present in these areas would likely be fully flight capable and able to disperse to neighboring undisturbed habitat as well. Design features such as retaining three of the largest snags per acre would also reduce the potential for disturbing important foraging areas and/or a potential nest site.

Indirect impacts described below, include those that have the potential to indirectly impact breeding and/or foraging activities by altering habitat conditions for white-headed

woodpeckers within the project area. The primary threat to white-headed woodpeckers is over-harvesting of mature, large diameter trees, especially ponderosa (or Jeffrey) pine (USDA, 1991).

Under the Proposed Action, conifer trees up to 24" dbh would be thinned from below on approximately 878 acres. In general, treatment proposed for these areas would result in more open stands with less understory vegetation. Stand densities would be reduced by as much as 50 to 70 percent in some units from the existing levels. Where stands are comprised of small diameter "dog-haired" trees, reductions in densities would likely improve habitat conditions for white-headed woodpeckers. In other areas, the reductions would likely have short term impacts causing white-headed woodpeckers to utilize adjacent areas where higher canopy cover has been retained. Under the proposed action, trees targeted for removal would be the smaller diameter trees that are competing with mature overstory trees. According to modeling runs using Forest Vegetation Simulator (FVS), this type of thinning would promote larger diameter trees which would eventually improve habitat for white-headed woodpeckers. Other design features, including retaining three of the largest snags per acre and large down woody debris, would continue to provide structural integrity of habitat for white-headed woodpeckers. Furthermore, fuels treatments in adjacent units would lower the potential of a severe, stand replacing wildfire and help protect important habitat for white-headed woodpeckers.

Aspen Stands:

Under the proposed action, approximately 118 acres of aspen stands would be enhanced by removing live conifers up to 1 ½ times the existing aspen tree height. Direct impacts from this activity may include flushing white-headed woodpeckers from nest sites and or foraging areas. Flushing adults repeatedly from the natal area could lead to mortality or low survival probability for incubating adults and/or nestlings. However, according to the Proposed Action, project activities would not occur in aspens stands until August when the peak breeding period has ended. Although some overlap may occur between nesting activities and timber removal, this would likely occur in August when juveniles are flight capable and able to disperse to neighboring suitable habitat. Furthermore, under the proposed action, three of the largest snags per acre would be retained, minimizing the potential for impacts to a potential nest sites.

Removal of conifer in aspen stands would likely result in a permanent reduction of potential habitat for white-headed woodpeckers. White-headed woodpeckers rarely nest in pure aspen, but would utilize conifers that occur within aspens stands. However, conifer-encroached aspen stands make up a small percentage (less than 2%) of the available habitat in the project area and are not considered the high quality habitat for white-headed woodpeckers. It is expected that the majority of nesting occurs primarily in pure conifer stands, particularly those within the PAC and adjacent stands of conifer where large snags and live trees are present. Therefore, impacts to white-headed woodpecker from aspen treatments are expected to be minor. Over the long-term, treatments in aspen may benefit white-headed woodpeckers by increasing the foraging availability. White headed woodpeckers primarily rely on conifer seeds for their diet but also rely on a number of

insects as a food source, particularly during the breeding period. Aspen stands are considered to be one of the most biologically diverse vegetation communities in the world, often containing relatively high moisture conditions ideal for producing an abundance of insects.

Prescribed Burning:

Prescribed burning would also be conducted within the project area (outside of the PAC). Most prescribed burning operations would likely happen in the fall, winter, or early spring.. White-headed woodpeckers, particularly juveniles, may be impacted from smoke associated with spring prescribed burning. However, burning conditions are designed to be low intensity and occur over very short time periods (usually ½ days for 1-2 days a year). Prescribed burning would be focused on burning the understory duff and small diameter trees and would therefore have little impact on habitat requirements for white-headed woodpeckers. Prescribed burning would reduce fuel loading in the project area and therefore reduce the potential for loss of habitat from a catastrophic wildfire.

Cumulative Impacts

The greatest risk to white-headed woodpeckers is loss of habitat from over-harvesting of mature, large diameter trees, especially ponderosa (or Jeffrey) pine. The Arrowhawk/Mt Rose area has been intensively managed in the past, prior to and after National Forest System acquisition in 1939. Large scale logging occurred in the 1850's and throughout the first part of this century where Comstock logging operations essentially denuded the landscape of conifer species. In more recent years, commercial and residential development has occurred in the area, fragmenting conifer stands and other vegetation communities. Within and adjacent to the analysis area, several fuels reduction projects have occurred both on private and public lands that have likely had some impacts to white-headed woodpeckers. Projects, such as North Washoe Fuels Reduction, reduced canopy cover by half and thinned trees to an average of 60 to 80 square foot basal area. Other projects surrounding private residences have also removed numerous trees and other vegetation to reduce and may have resulted in reduced habitat availability for white-headed woodpeckers. However, fuels reduction projects proposed and implemented throughout the District, including the Arrowhawk Fuels Project, would also help lower the potential for a catastrophic stand replacing wildfires that could completely eliminate habitat in localized areas.

For example, in 2007, the Hawken fire burned approximately 3000 acres of timber and brush along the Sierra front. It is not known if any white-headed woodpecker nest sites were lost as a result of this fire, but potential habitat for this species was likely reduced. Natural regeneration and Forest Service reforestation efforts are expected to help restore some of this habitat in the long term. Standing snags resulting from the fires may also help improve potential nesting habitat for white-headed woodpeckers, particularly in those areas where snags are surrounded by large patches of live, intact trees. Forest Service fuels reduction projects proposed throughout the District, including the Arrowhawk Fuels Project, would help maintain white-headed woodpecker habitat by lowering the potential for future catastrophic stand replacing wildfires. In general, as surrounding developed areas increase in population, recreation use along the Sierra Front is also likely to increase.

Determination: Under the Proposed Action, some impacts to white-headed woodpeckers are expected to occur. However, these impacts would be temporary and offset by improved habitat conditions in some portions of the project area following treatment activities. Based on the above assessment, it is my determination the project may impact individual white-headed woodpeckers but would not lead to a trend toward federal listing or a loss of viability.

MANAGEMENT INDICATOR SPECIES

Yellow Warbler

Portions of the Arrowhawk project area contain abundant riparian vegetation suitable for yellow warblers such as willow, alder and bitter cherry. Migratory bird surveys conducted in the project area resulted in no detections of yellow warblers. Habitat destruction and brown-headed cowbird parasitism are the biggest threats to yellow warblers.

Under the proposed action, direct effects to yellow warblers include flushing birds from nest and foraging sites during project activities, particularly those that involve thinning immediately near drainages. Disruptions to breeding could lead to mortality of eggs and/or juveniles and allow for the increased risk of nest parasitism. However, under the proposed action thinning of riparian areas and aspen stands would not occur until after the breeding cycle for yellow warblers. Eliminating activity during the critical breeding period would greatly reduce any impacts from disturbance. Indirectly, yellow warblers could be affected from the removal of vegetation during thinning operations in drainages and upland habitats. Yellow warblers require shrubs and small trees of adequate height to provide perching and foraging habitat. Reduction in shrubs could cause yellow warblers to avoid the area during migration. However, under the proposed action the reduction in forested canopy cover would likely result in the increase in shrubs in the drainages and some upland areas.

Cumulative effects

Population trends for the yellow warbler have been decreasing in the Sierra Nevada over the last forty years. Local, large scale wildfires that have recently occurred in the area have likely reduced habitat for yellow warblers. For example, portions of perennial streams and riparian vegetation burned during the 2001 Martis fire where high intensity fire burned along riparian corridors. However, the abundance of shrub regeneration following these fires, may also have improved habitat for the species in some areas. Loss of habitat for yellow warblers in wintering areas may also be impacting yellow warblers. The Arrowhawk fuels reduction project is not expected to cumulatively impact yellow warblers as riparian vegetation would be retained and the majority of project activities would occur after the breeding season.

Determination: Based on the above assessment, the proposed action may affect individual yellow warblers, but would not affect habitat and would not lead to a downward trend in the population.

Yellow-Rumped Warbler

Habitat for yellow-rumped warblers occurs throughout the Arrowhawk project area where

conifer stands are present. A total of four yellow-rumped warblers were detected during migratory bird surveys conducted in the project area.

Under the proposed action, direct effects to yellow-rumped warblers include flushing birds from nesting and or foraging areas during project activities. Disruptions to breeding could lead to mortality of eggs and/or juveniles and allow for the increased risk of nest parasitism.

Indirectly, removal of vegetation could temporarily cause yellow-rumped warblers to avoid the area for nesting and or foraging. However, yellow-rumped warblers are known to occur in a variety of mixed conifer types and densities and are therefore expected to utilize conifer stands following treatment. Furthermore, pockets of trees would be retained and would continue to provide adequate nesting habitat for yellow-rumped warblers.

Cumulative effects

Local, large scale wildfires that have recently occurred in the area have likely reduced habitat for yellow-rumped warblers. However, regeneration of these stands is occurring and overtime would provide habitat for yellow-rumped warblers in the future. Population trends of yellow-rumped warblers appear to be increasing in the state of Nevada, indicating suitable habitat conditions are available. Reforestation efforts associated with the burned areas would continue to improve habitat conditions for yellow-rumped warblers.

Determination: Based on the above assessment, it is expected that the proposed action may have minor impacts on yellow-rumped warbler habitat, but would not lead to a downward trend in the population.

Hairy woodpecker and Williamson's sapsucker

Habitat requirement for hairy woodpecker and Williamson's sapsucker are similar to white-headed woodpeckers and other late-seral associated species discussed previously. Therefore, habitat parameters described for the white-headed woodpecker (and other late-seral related species) are also used for the below effects analysis for hairy woodpecker and Williamson's sapsucker.

Under the proposed action, direct effects to hairy woodpeckers and Williamson's sapsuckers include flushing birds from nesting and or foraging areas during project activities. Disruptions to breeding could lead to mortality of eggs and/or juveniles and allow for the increased risk of nest parasitism. However, under the proposed action, only minimal activity would occur in the flammulated owl PAC area which contains the highest quality habitat for both woodpeckers. Project activities would not occur in the PAC until well after September which is well after the breeding period for hairy woodpeckers and Williamson's sapsuckers. Outside of the PAC, project activities would not occur in aspen stands until after the breeding season for most migratory birds (May through July) which would reduce the potential for disturbance to nesting birds. Furthermore snags with obvious cavities would not be removed, decreasing the potential for inadvertent nest destruction.

Williamson's sapsuckers and hairy woodpeckers could be affected from a reduction in canopy cover and structural diversity within the project area. Both species require conifer

and/or deciduous stands that include large diameter snags and some structural diversity within the stand. Loss of these habitat features is considered one of the largest threats to both of these species. However, under the proposed action, the flammulated owl PAC area would include only minimal hand thinning of small diameter trees. No snags or large diameter trees would be removed and enough understory trees would be retained to provide structure. Design features for the remainder of the project area, such as maintaining at least three of the largest snags per acre and down woody debris over 12 inch diameter would minimize the impacts to woodpecker habitat. In aspen stands, conifer removal may, in the short term, impact Williamson's sapsuckers and hairy woodpeckers by reducing suitable foraging and nesting habitat. However, the improvements to aspen stands from removing conifer would in the long-term, compensate for habitat loss from conifer removal and would eventually benefit both of these species. For example, in a study conducted on the Lassen National Forest, the abundance of hairy woodpeckers significantly increased one and two years following conifer removal in aspens stands (Burnett et al 2008). Williamson's sapsuckers also showed a slight increase as did a number of other migratory and resident bird species.

Cumulative effects

Local, large scale wildfires that have recently occurred in the area have likely had mixed impacts on hairy woodpeckers and Williamson's sapsuckers. Although thousands of acres of forested lands were burned, numerous snags were created, many of which remain adjacent or within patches of live, in-tact stands of conifer and/or aspen. Removal of firewood and hazardous tree products has likely had some negative impacts on both of these woodpeckers. However, requirements associated with these projects were designed to protect woodpecker habitat by including a diameter limit of 24" and no removal of snags with cavities. Population trends for hairy woodpeckers and Williamson's sapsuckers appear to be stable and/or increasing in the state of Nevada, indicating suitable habitat conditions are available. Reforestation efforts associated with the burned areas would continue to improve habitat conditions for hairy woodpeckers and Williamson's sapsuckers.

Determination: Based on the above assessment, it is expected that the proposed action may have minor, short term negative impacts to hairy woodpecker and Williamson's sapsucker habitat, but in the long term would likely improve habitat conditions for these species and would not lead to a downward trend in the population.

Sage Grouse

Sage grouse are not known to occur in the project area currently or historically. Portions of the project area contain brush stands with a sagebrush component that may be suitable for sage grouse. However, the majority of the brush stands in the area are dominated by manzanita and ceonothus and do not contain contiguous stands of sage brush. The project area is not within or adjacent to a PMU.

Determination: Based on the above assessment, the proposed action would not affect sage grouse habitat and would not cause populations to trend downward.

Mule Deer

Under the proposed action, direct effects to mule deer include displacement of deer during project activities. The effects of disturbance to mule deer may be greater during the winter months when deer are often relying on energy reserves for survival. If disturbance levels are consistently high, deer may permanently avoid these areas and subsequently productivity of the herd may be reduced. However, under the proposed action, the majority of the project activities would occur outside of the winter months (to avoid resource damage) and therefore would minimize the impact to mule deer from disturbance.

Project activities occurring during the late spring and summer months may impact deer transitioning from winter to summer range or deer seeking cover in aspen and conifer stands. However, suitable habitat for mule deer surrounds the project area and would provide easily accessible refuge for mule deer during project operations. Furthermore, because the project area is not occurring in critical fawning habitat, deer occupying the project area would primarily be adults who are mobile and able to disperse to adjacent undisturbed suitable habitat during project operations.

Mule deer may also be directly affected from targeted sheep grazing which would occur in the cheatgrass dominated areas. The majority of cheatgrass infested areas occur in the lower elevations where deer typically winter. Depending on snow levels, there is a potential for sheep to be present at the same time wintering deer are still in the area resulting in competition for food and other resources.

Although competition may occur, the effects would be short term and minor. Sheep would only be present in the project area for short durations during cheatgrass “green-up” and would be focused in the more open areas that lack brush and are dominated by cheatgrass. By contrast mule deer would concentrate in the brushy areas and would likely be transitioning upslope toward summer habitat during that time (approximately late April or early May). Over the long term, targeted grazing would benefit mule deer by reducing cheatgrass levels and allowing native, perennial species to be re-established. The conversion of critical winter range to cheatgrass and other noxious weeds is considered a major threat to mule deer populations in the State of Nevada (Wasley 2004).

Indirect effects to mule deer summer and transition range include the reduction in tree cover both in conifer and aspen stands proposed in the upper elevations of the project area. Mule deer rely on conifer and aspen stands, particularly on summer and transitional ranges, to provide thermal and security cover (Carson and Peak 1987). Mule deer tend to prefer conifer stands in early to mid-seral stages due to the relative abundance of understory vegetation typically present in the younger stands. Deciduous forests, such as cottonwood or aspen, provide overhead shade and open under stories to allow passage of cool breezes during summer. Mule deer also rely on aspen communities for food, cover, hiding, and protection from severe weather, making it a popular habitat type for them three seasons of the year. Under the proposed action, conifer would be completely removed from approximately 118 acres of aspens stands. In the short term, the reduction in conifer would reduce the overall canopy cover in aspens stands and subsequent thermal protection for mule deer. In the long term, however, the removal of conifers would promote the regeneration of aspen and other

understory vegetation thereby improving habitat for mule deer. In conifer stands outside of aspen areas, thinning of conifer would also reduce thermal cover and protection for mule deer. However, the decrease in canopy cover would likely benefit mule deer in the long term, as shrubs and other vegetation are reestablished in the understory providing mule deer with quality summer forage.

In the lower portions of the project area, thinning of brush stands would occur in some areas considered critical winter range for mule deer. Brush stands would be thinned between 30 and 80 % with more intensive treatments occurring in high risk areas (near structures). In areas where structures are not threatened, brush would be treated in a mosaic pattern to allow for adequate cover and forage for mule deer. In the short term, some cover and forage habitat for mule deer would be reduced as tall shrubs are topped and some removed from mastication equipment. However, the stems and roots of most shrubs would be left intact allowing re-sprouting of existing shrubs and regeneration of new shrubs to occur. In general, younger shrubs provide more nutritious and palatable forage for mule deer. Therefore, any loss of cover would be offset from the benefits of improved forage capability of the new growth.

Prescribed burning in the shrub communities would also improve habitat conditions by stimulating seed production of both grasses and shrubs. Under the proposed action, areas considered as high risk for additional cheatgrass invasion would be seeded following mastication and/or prescribed burning operations. Seeding with native vegetation would minimize the risk of noxious weed spread within the project area.

Cumulative effects

Over the last two decades, urban development along the Carson front has reduced critical winter range significantly for mule deer and has contributed to the overall decline of the Loyalton-Truckee herd. Large scale development projects proposed along the I-80 corridor in the Verdi and Truckee area would further reduce critical deer winter range for this herd. Recent catastrophic wildland fires have also played a role in herd reduction by completely eliminating thousands of acres of critical winter, transition and summer range. Although fires in some areas have been beneficial for mule deer by stimulating new growth of important shrubs, in other areas, native vegetation has been replaced by invasive or non-native species that provide little or no forage value for mule deer.

Forest Service fuels reduction projects in the Mount Rose area may cumulatively add to habitat concerns for mule deer. Fuels treatments such as brush mastication and tree thinning reduce cover and temporarily displace deer. However, most brush thinning treatments are designed to retain a mosaic patchiness to provide cover and forage for mule deer while still reducing fuel loading. Masticated brush often re-sprouts within months of being treated offering deer more nutritious forage than decadent, older brush. To reduce stress and displacement to mule deer during the winter, mastication and other mechanized treatments are not conducted during the winter months in critical winter range areas.

In recent years, the Forest Service, in cooperation with the Nevada Department of Wildlife and other Federal and non-profit agencies has implemented several deer habitat restoration

projects in order to improve habitat in these areas. For example, collected mahogany and bitterbrush seedlings were planted within the boundaries of the Hawken Fire area in spring of 2010 restoring over 1000 acres of habitat for the Loyalton –Truckee herd. Other restoration efforts designed to improve habitat for mule deer include brush and tree planting in the Robb, Waterfall, Highway 50 and Voltaire fires; brush stimulation in the Jack's Valley Wildlife Management area and habitat restoration at Canepa Ranch in the I-80 corridor.

Determination: Based on the above assessment, it is expected that some disturbance to mule deer may occur from implementation of the proposed project. However, the overall disturbance to mule deer is expected to be minor and temporary. Reductions in cover habitat for mule deer would be offset from the benefits of increased forage production and overall improvements to critical habitat. Therefore, the proposed action may affect individual mule deer, but would eventually improve habitat and would not contribute to a downward trend in the population of the Loyalton-Truckee deer herd.

American Marten

The highest quality habitat for marten within the project area includes the flammulated owl PAC area, as well as dense conifer stands found along portions of the Jones, Whites, and Thomas Creek riparian corridors. Surveys conducted in the project area in 2011 resulted in no detections of marten.

Direct effects from the proposed action include displacement of marten during logging and other project operations. However, furbearer surveys conducted in the project area during the summer of 2011 resulted in no detections of marten. Furthermore, the most suitable habitat for marten occurs in the flammulated owl PAC where treatment is proposed to be minimal. Similarly, retained wildlife pockets along riparian corridors also contain high quality habitat and would receive only minimum treatment.

In other areas, approximately 878 acres of conifer forest would be thinned using ground based and helicopter logging systems. Within these areas, trees up to 24" dbh would be removed with an average target basal area of 90 square feet. In some areas, this would result less than half of the existing basal area being retained. Indirectly, marten could be affected from a reduction in canopy cover and structural diversity within the project area. Marten typically require habitat features associated with late-seral coniferous forests such as dense canopied (60-100%), multi-storied stands with numerous large diameter snags. However, under the proposed action, design features such as maintaining at least three of the largest snags per acre and down woody debris over 12 " in diameter would minimize the impacts to marten habitat. As mentioned above, the flammulated owl PAC and other important habitat areas for marten would only receive minor treatments that would not negatively impact marten habitat.

Cumulative effects

The primary threat to marten is the loss of late successional habitat. Over the last several decades, numerous tree and brush thinning projects have occurred along the Sierra front primarily to reduce fuel loading. Much of this area is also open annually to public fuelwood

cutting and Christmas tree cutting and is also a highly used by recreationists for hiking, skiing, mountain bike riding and camping.

Marten are generally able to tolerate some human disturbance as long as habitat conditions remain intact (Koehler et al 1975). For example, marten have been reported in high numbers at several ski resorts along the Cascades and Sierra Nevada eating human food, using resort structures as rest sites, and are frequently detected under lift lines via their tracks in snow. The above described activities may be having some short term impacts on marten from human disturbance and alterations to habitat. The Arrowhawk Fuels Reduction project may also result in some short term impacts to the species. In the long term, however, the benefits from improvements to forest health as well as reduced threats of catastrophic fire, would improve habitat conditions for marten.

Determination: Based on the above assessment, it is expected that the proposed action may have minor, short term impacts on individual marten, but would not alter habitat conditions for this species and would not lead to a downward trend in the population.

Macroinvertebrates

Under the proposed action, the use of ground-based equipment for thinning, construction of skid trails and temporary roads, and prescribed burning may have some impacts on soils and water quality. The direct and indirect effects of these actions can include soil disturbance and erosion, soil compaction, increased runoff, and sediment delivery to stream channels. It is assumed that any activity that may increase erosion, or streambank destabilization, or loss of shading would affect water quality and likely have some negative effects on aquatic insects. However, the risk of impacts to soil and water would be reduced through implementation of Best Management Practices (BMPs), which are described in the Design Features section of the EA. The water and soils measures are designed to minimize soil disturbance and protect stream channels and riparian areas.

According to the watershed analysis conducted for this EA, the short term effects to soil and water quality from ground-based thinning and mastication would likely be minimal and the long term water quality and soil quality would be maintained. The watershed assessment also concluded that water and soil quality would be maintained following prescribed burning activities. If no action is taken it is assumed that all or part of this area would burn as a wildfire. High severity wildfires can remove much of the vegetation, along with duff and litter from the forest floor. Wildfires are usually more severe than prescribed fire and, as a result, they are more likely to produce significant effects on soil and water quality and consequently affect macroinvertebrate populations.

Determination: Any effects to macroinvertebrates from project activities are expected to be minimal and temporary and would be confined to specific, relatively small areas. Therefore, the proposed action would not affect habitat or lead to a downward trend in macroinvertebrate populations.

Other Species Considered

Mountain Beaver

A large mountain beaver colony occurs approximately .25 miles outside of the project area. Because mountain beavers live primarily underground, have small home ranges and are well outside the project area there would be no impacts to the colony or their habitat from the proposed project.

Determination: The proposed action would not affect habitat or lead to a downward trend in mountain beaver populations.

Neotropical Migratory Birds (NTMB*)*

Direct effects to migratory birds can occur from inadvertent trampling or flushing birds from perches and nest sites during project activities. Repeated intrusions during the nesting season may cause birds to minimize or stop singing, decrease defensive behavior at nests, and possibly cause birds to abandon nest sites leading to an overall decline in nesting productivity (Knight and Tempel 1986). Along the Eastern Sierra, the breeding season for many NTMB is generally between March 1st and August 30th depending on species and elevation (Heath and Ballard 1999). Under the proposed action, no project activities would occur in aspen stands and riparian areas between April and July which would minimize impacts during the majority of the breeding period for most NTMB for those elevations (between 5,500 and 6,500 feet elevation). Birds occurring as this elevation range typically have ended their breeding cycles mid to late July. In areas outside of aspen stands, project operations can occur during the breeding season which may increase the potential for impacts to nesting birds. However, snags with obvious cavities would be avoided and pockets of trees would be retained within treatment areas also providing undisturbed habitat for NTMB. A variety of migratory and resident birds have the potential to occur within the project area (See Tables 7).

Large reductions in habitat can fragment habitat and act as barriers to migratory bird corridors. Habitat fragmentation is considered the major factor for population declines in migratory bird species, particularly when the fragmentation occurs within riparian zones (Hutto 1995).

Under the proposed action, design features such as retaining at least three of the largest snags per acre and down woody debris over 12 “in diameter would also help maintain the structural integrity of the stands. In areas not located directly behind homes, brush would be treated in a mosaic pattern, leaving large patches of brush intact to provide cover for NTMBs and other wildlife. In aspen stands, reductions in conifer may have some short term impacts on some NTMB, especially those species that are typically more adapted to a conifer habitat types such as dusky flycatcher.

Conifer removal would improve the overall health of the aspen stand by opening up the canopy and allowing new aspen shoots and understory vegetation to grow. The increased floristic diversity following treatment is expected to result in an increase in abundance and

diversity of NTMB as well. For example, in a study conducted on the Lassen National Forest, the abundance of several species migratory and resident birds significantly increased one and two years following conifer removal in aspens stands (Burnett et al 2008). The study also found that the newly opened habitat conditions created through removal of conifer attracted a new suite of species which were typically absent from untreated aspen such as tree swallow, chipping sparrow, and mountain bluebird (Ibid)

Cumulative effects

On the Carson front, recent wildfires have burned over 25,000 acres of trees and shrubbed landscapes, reducing available nesting and foraging habitat for a number of migratory birds. However, habitat conditions are gradually improving in these burned area from natural regeneration and Forest Service tree and brush planting efforts. Surrounding fuels reduction projects, including Mt. Rose and North Washoe, may have had some short term effects on migratory birds. Effects to birds from these projects, as well as the Arrowhawk fuels reduction project, are expected to be temporary and offset by the improved habitat conditions that would result over the long term.

Determination: Based on the above assessment, although some migratory birds may be temporarily displaced, the proposed project would not lead to a downward trend in migratory bird populations and may improve habitat in the long-term for some species.

CONSULTATION AND COORDINATION

The opportunity for public participation in the analysis of this project was initiated through publication in the Schedule of Proposed Actions in 2008 and 2009. A 30-day public scoping period began on March 4, 2009, with the Scoping Document mailed to 82 individuals, organizations or agencies. This document was also available on the World Wide Web at: http://www.fs.usda.gov/htnf/. In addition, a public meeting was held on September 8, 2009

ID TEAM MEMBERS

Name	Position	Area of Expertise
Amanda Brinnand	Zone Silviculturist	Vegetation
Beth Nabors	Fuels Planner	Fire/Fuels
Steve Howell	Fuels Specialist	Air Quality
Maureen Easton	Wildlife Biologist	Wildlife/Sensitive Plants/Noxious/Invasive Weeds
Sally Champion	Hydrologist	Water/Soils
Joe Garotto	Archaeologist	Heritage Resources
David Reis	Recreation planner	Visuals/Recreation

FEDERAL, STATE, AND LOCAL AGENCIES

U.S. Fish and Wildlife Service

Nevada Department of Wildlife

Nevada State Historic Preservation Officer

Nevada Division of Forestry

Sierra Fire Protection District

TRIBES

Washoe Tribe of Nevada and California

Reno/Sparks Indian Colony

OTHERS

Nevada Fire Safe Council

BIBLIOGRAPHY

Arsenault, D. P., G.E. Wilson, and, L. Neel. 2002. Flammulated Owls in the Spring Mountains, Nevada. Avian Research Center of Nevada, Reno, NV. 11 pp.

Bales, R. C., J. J. Battles, Y. Chen, M. H. Conklin, E. Hoist, K. L. O'Hara, P. Saksa, and W. Stewart. 2011. Forests and water in the Sierra Nevada: Sierra Nevada watershed ecosystem enhancement project. Sierra Nevada Research Institute, UC Merced, CA. Center for Forestry, UC Berkeley, Ca. Environmental Defense Fund, Sacramento, CA.

Beyer, Cheryl. 2011. Phone conversation with the Forest Botanist for the Lake Tahoe Basin Management Unit regarding locations of *Orthotrichum shevockii* in the Carson Range, LTBMU and fuel reduction project mitigations. Sept. 22, 2011.

Bossard, C. C., J. M. Randall, and M. C. Hoshovsky. 2000. Invasive Plants of California's Wildlands. University of California Press: Berkeley, CA.

Brennan L., W.M. Block, and R.J. Guitierrez. 1987. Habitat use by mountain quail in northern California. Condor 89:66-74.

Burnett, R. D, Jongsomjit, D., Herzog, M., Stralberg, D., Ellis, T., Humple. D. 2008. Avian Monitoring in the Lassen and Plumas National Forests: 2007 Annual Report. PRBO Conservation Science; Contribution #1620, Petaluma, CA

California Native Plant Society (CNPS). 2012. Inventory of Rare and Endangered Plants (online edition, v7-07c). California Native Plant Society, Sacramento, CA. Accessed from http://www.cnps.org/inventory.

Carey, A.B. Horton, S.P. and B.L. Biswell. 1992. Northern spotted owls: influence of prey base and landscape characteristics. *Ecological Monographs* 62: 223-250.

Carson, G.R., and J.M. Peak. 1987. Mule deer habitat selections in North Central Washington. J. Wildlife Management 51 (1): 46-51

CDFG- California Department of Fish and Game. 1990. California's Wildlife Vol. II Birds, *Flammulated owl*. Pages: 122, 130, 310, 322, and 394.

Connelly, J.W., M.A. Schroeder, A.R. Sands, and C.E. Braun. 2000. Guidelines to manage sage grouse populations and their habitats. Widl. Soc. Bulletin. 28(4): 967-985.

Cornell University Laboratory of Ornithology 2012. Accessed on-line at website

-http://birds.cornell.edu/BOW/WHHWOO

-http://www.allaboutbirds.org/guide/Hairy_woodpecker/lifehistory

-http://www.allaboutbirds.org/guide/Yellow-rumped_Warbler/id

Cox, M. 2011. Nevada Department of Wildlife 2010-2011 Big Game Status Report. Loyalton Truckee Interstate Mule Deer Herd. pp 20. Nevada Department of Wildlife, Reno Nevada.

Cronquist, A., A.H. Holmgren, N.H. Holmgren, and J.L. Reveal. 1972. Intermountain Flora, vol. 1. New York Botanical Garden, The Bronx, New York.

Dixon, R.D. 1995. Ecology of White-headed Woodpeckers in the central Oregon Cascades. Master's thesis, University of Idaho, Moscow, ID.

Dixon, G.E. 2011. Essential FVS: A user's guide to the Forest Service vegetation simulator. Forest Management Service Center, Fort Collins, CO.

Dunham, S., L. Butcher, D.A., Charlet, and J.M. Reed. 1996. Breeding range and conservation of flammulated owls (*Otus flammeolus*) in Nevada. J. Raptor Res. (30) 4:189-193.

Elston, Robert, Suzan Stornetta, Daniel P. Dugas, and Peter Mires. 1994. *Beyond the Blue Roof: Archaeological Survey on Mount Rose Fan and Northern Steamboat Hills Intermountain* Research Silver City, Nevada October 1994

Erlich P.R., and D.S. Dobkim, and D. Wheye. 1988./ The Birders Handbook: A field Guide to the Natural History of the North American Birds. The Essential Companion to your Identification Guide. Simon and Schuster Publishing. PP. 532

Evans, A. M., Everett, R. G., Stephens, S. L., and J. A. Youtz. 2011. Comprehensive fuels treatment practices guide for mixed conifer forests: California, central and southern Rockies and the southwest. U.S. Forest Service Forest Guild.

Farrar, D. Ph.D, 2005. Personal communication via email with Dr. Donald Farrar, Iowa State University, regarding habitat for moonworts, September 14, 2005.

Finch, D. M. 1991. Population Ecology, Habitat Requirements, and Conservation of Neotropical Migratory Birds. USDA Forest Service Gen. Tech., Rep. RM-205, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.

Freel, M. 1991. A Literature Review for Management of Fisher and Marten in California. Unpublished Document, United States Department of Agriculture Forest Service, Pacific Southwest Region. 18pp.

Gardali, T., G. Ballard, N. Nur, and G. Geupel. 2000. Demography of a declining population of Warbling Vireo. Condor 102:601-609.

Garrett, Kimball L., Martin G. Raphael and Rita D. Dixon. 1996. White-headed Woodpecker (Picoides albolarvatus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/252.

GBBO (Great Basin Bird Observatory). 2003. Nevada Bird Count. A Habitat-Based Monitoring Program for Breeding Birds of Nevada. Instruction Package and Protocol for Point Count Surveys.On file at Carson Ranger District, Carson City, NV.

GBBO (Great Basin Bird Observatory). 2010. Nevada Comprehensive Bird Conservation Plan, ver. 1.0. Great Basin Bird Observatory, Reno, NV. Available online at www.gbbo.org/bird_conservation_plan.html.

Graham, R. T., A. E. Harvey, T. B. Jain, and J. R. Tonn. 1999. The effects of thinning and similar stand treatments on fire behavior in western forests. Gen. Tech. Rep. PNW-GTR-463. Portland, OR, USDA Forest Service, Pacific Northwest Research Station. 27 p.

Graham, R., S. McCaffrey, and T. Jain. 2004. Science basis for changing forest structure to modify wildfire behavior and severity. US Forest Service General Technical Report RMRS-GTR-120. Fort Collins, Colorado.

Hatchett B, Hogan M, Grismer M. 2006. Mechanical mastication thins Lake Tahoe forest with few adverse impacts. Cal Ag 60(2):77-82. DOI: 10.3733/ca.v060n02p77

Hayward G.D. and R. E. Escano. 1989. Goshawk Nest-Site Characteristics in Western Montana and Northern Idaho. The Condor , Vol. 91, No. 2 (May, 1989), pp. 476-479.

Heath, S.K., and G. Ballard, 1999. Eastern Sierra Riparian Songbird Conservation. PointReyes Bird Observatory, Stinson Beach, CA

Heron, G., C.A. Motimore, M.S. Rawlings. 1985. Nevada Raptors: Their biology and management. Nevada Dept. of Wildlife, Reno, NV.

Hoffman, C., R. Mathiasen and C.H. Sieg. 2007. Dwarf mistletoe effects on fuel loadings in ponderosa pine forests in northern Arizona. Can. J. For Res. 37:662-670.

Hutto, R.L. 1995. Composition of bird communities following stand-replacement fires in northern Rocky Mountain conifer forests. Conservation Biology. 9(5): 1041-1058.

JFSP. 2011. Mastication on red mountain: Investigating fuel loads and fire effects. Joint Fire Science Program Fire Science Brief Issue 125.

Johnsgard, P.A. 1973. Grouse and Quails of North America. Univ Nebraska Press, Lincoln. 553 p.

Johnson-Groh, C. C.Reidel, L.Schoessler, and K. Skogen. 2002a. Below ground distribution and abundance of Botrychium gametophytes and juevenile sporophytes. American Fern Journal 92:80-92.

Johnson-Groh, C.L., and J.M. Lee. 2002b. Phenology and demography of two species of *Botrychium* (Ophioglossacease). American Journal of Botany 89 (10): 1624-1633.

Johnson-Groh, C. and D. Farrar. 1996. The effects of fire on prairie moonworts (*Botrychium* subgenus *Botrychium*). American Journal of Botany. 83:134

Keane, J. J. 1999. Ecology of the northern goshawk in the Sierra Nevada, California. Ph.D Dissertation, University of California, Davis.

Kennedy, P.L. and J.M. Ward. 2003. Effects of experimental food supplementation on movements of juvenile northern goshawks (*Accipiter gentilis*). Oecologia. 134:284–291

Knight, R.L., and S.A. Temple. 1986. Why does intensity of avian nest defense increase during the nesting cycle? Auk 103:318-327 MacArthur, R.H. and J.W. MacArthur 1961. On bird species diversity. Ecology 42:594-598.

Koehler, G.M., W.R. Moore, A.R. Taylor. 1975. Preserving the pine marten, management guidelines for western forests. Western Wildlands Summer 1975: Montana Forest and Conservation Experiment Station, University of Montana, Missoula, MT.

Lacy, RC; Clark, TW. 1993. Simulation modeling of American marten (Martes americana) populations: Vulnerability to extinction. Great Basin Naturalist. Vol. 53, no. 3, pp. 282-292. 1993.

Launchbaugh, K.L., J. W. Walker, and R. Daines [eds]. 2006. Targeted grazing: A natural approach to vegetation management and landscape enhancement. American Sheep Industry Association, Centennial, CO. 199 p.

Lewinsky-Haapsaari, Jette and Daniel Norris. 1998. *Orthotrichum shevockii* (Orthotrichaceae), a new moss species from the Southern Sierra, California. The Bryologist 101(3), pp.435-438.

Malmsheimer, R.W., P Heffernan, S. Brink, D. Crandall, F. Deneke, C. Galik, E. Gee, J.A. Helms, N. McClure, M. Mortimer, S Ruddell, M. Smith, and J. Stewart. 2008. Preventing GHG emissions through wildfire behavior modification. Journal of Forestry 106(3):141-144.

Martin S.K., and R.H. Barrett. 1991. Resting site selection by marten at Sagehen Creek, California. Northwestern Naturalist. 72: pp.37-42.

McCallum, D.A. 1994. Methods and terminology used with studies of habitat associations *in* Flammulated, Boreal, and Great Gray Owls in the United States, a Technical Conservation Assessment. Gen Tech. Rep. RM-253. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Co.

Megahan, W.F. 1980. Nonpoint source pollution from forestry activities in the western United States: results of recent research and research needs. Proceedings of Conference on U.S. Forestry and Water Quality. June 1980 Richmond, VA.

Mika, M. and B.R. Riddle 2006. Biological Investigation of Flammulated owl (*Otus flammeolus*) Distributions and densities on National Forest Lands in Nevada: Status Report for 2005 (on file at Carson ranger District).

Morefield, J.D. 2000. Current Knowledge and Conservation Status of *Eriogonum robustum* E. Greene (Polygonaceae), the altered andesite buckwheat. Status Report prepared for the U.S.Fish and Wildlife Service, Reno Nevada. 37pgs with additional appendices.

Morefield, J. D. (ed.). 2001. Nevada Rare Plant Atlas. Carson City: Nevada NaturalHeritage Program, compiled for the U.S. Department of Interior, Fish and Wildlife Service, Portland, Oregon and Reno, Nevada.

Morefield, J.D. 2002. Conservation Status Report for *Arabis rectissima* E. Greene var. *simulans* Rollins (Brassicaceae), the Washoe Tall Rockcress. (updated September 2003). Status Report prepared for the U. S. Fish and Wildlife Service, Reno Nevada. 15pgs with additional appendices.

NDA, Nevada Department of Agriculture. 2012 Nevada Weed Laws. Accessed at: http://agri.nv.gov/nwac/NDOAPolicyStatement3-05.pdf

NDOW, Nevada Department of Wildlife, 2012. Animals of Nevada Fact Sheets. Information obtained online at: http://ndow.org/wild/animals/facts/birds_mountain_quail.shtm

Neal, F. D., and J. E. Borrecco. 1981. Distribution and relationship of mountain beaver to openings in sapling stands. Northwest Sci. 55:79-86.

Neel L. 2001. Nevada Sage Grouse Conservation Strategy. Governor Kenny Guinn's Sage Grouse Conservation Planning Team, Carson City, NV.

Nelson, Lynda. 1989. Survey Findings on *Arabis rigidissima* var. *demota*, Galena Creek rockcress. Report submitted to the Galena Ski Area Corporation. On file at the Carson Ranger District. 17pgs.

Nevada Natural Heritage Program (NNHP) 2004. Status of dainty moonwort (*Botrychium crenulatum*) in the State of Nevada. Accessed at: http://heritage.nv.gov/lists/storegon.htm

Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/ accessed June 2011.

Pope, M. and J. Crawford. 1999. Mountain Quail Research: Annual Report 1999. Oregon State University.

Reynolds, R.T., E.C. Meslow, H.M. Wight. 1982. Nesting habitat of coexisting *accipiters* in Oregon. J. Wildl. Manage. 46(1): pp124-137.

Reynolds, R.T., R.T. Graham, M.H. Reiser, R.L. Bassett, P.L. Kennedy, D.A. Boyce, Jr., G. Goodwin, R. Smith, and E.L. Fisher. 1992. Management recommendations for the northern goshawk in the southwestern United States. General Technical Report RM-217. Rocky Mountain Forest and Range Experiment Station, USDA Forest Service, Ft. Collins, CO.

Robinson, S.K. 1997. The case of the missing songbirds. *In* Consequences Volume 3, Number 1 Online at : http://www.gcrio.org/CONSEQUENCES/vol3no1/songbirds.htm.

Ryser, F.A., Jr. 1985. Birds of the Great Basin. University of Nevada Press, Las Vegas and Reno, Nevada. Pp. 461-464.

Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2011. *The North American Breeding Bird Survey, Results and Analysis 1966 - 2009. Version 3.23.2011 USGS Patuxent Wildlife Research Center, Laurel, MD*

SERC, Smithsonian Environmental Research Center. 2003. Avian Ecology: Effects of forest fragmentation on migratory songbirds: temporal and modeling perspectives. Online at: http://www.serc.si.edu/migratorybirds/breed_forest_frag.htm

Schroeder, M.A., J.R. Young, and C.E. Braun. 1999. Sage grouse (*Centrocercus urophasianus*) *in* A. Poole and F. Gill (eds.)The Birds of North America No. 425. Pp. 1-20. The Birds of North America Inc., Philadelphia, PA.

Scott, J. H. and E. D. Reinhardt. 2001. Accessing crown fire potential by linking models of surface and crown fire behavior. USDA Forest Service Rocky Mountain Research Station Research Paper RMRS-RP-29. Fort Collins, CO.

Shepperd, W. D. 2001. Manipulations to regenerate aspen ecosystems. USDA Forest Service Proceedings RMRS-P-18.

Shepperd, W. D., P. C. Rogers, D. Burton and D.L. Bartos. 2006. Ecology, biodiversity, management, and restoration of aspen in the Sierra Nevada. USDA RMRS-GTR-178.

Sibley, D. A. 2000. National Audubon Society. The Sibley Guide to Birds. Alfred A. Knopf, New York.

Siegel, R.B. and D.F. DeSante. 1999. Draft Avian Conservation Plan for the Sierra Nevada Bioregion: Report to California Partner in Flight: Conservation priorities and strategies for safeguarding Sierra bird populations. Point Reys Bird Observatory, Point Reyes, CA.

Sousa, P.J. 1987. Habitat suitability index models: Hairy woodpecker. U.S. Fish & Wildlife Service Biol. Rep. 82 (10.146).19 pp.

Squires, J.R. and R.T. Reynolds. 1997. Northern Goshawk, No. 298 in Birds of North America series, c/o Academy of Natural Sciences, 1900 Benjamin Franklin Parkway, Philadelphia, PA. 31 pp.

Squires, J. R. and P.L. Kennedy. 2006. Northern goshawk ecology: an assessment of currentknowledge and information needs for conservation and management. Studies in Avian Biology No. 31:8–62.

Tappeiner II, J. C., D. A. Maguire, and T. B. Harrington. 2007. Silviculture and ecology of Western U.S. forests. Oregon State University Press, Corvallis, OR. Pg 171.

Terres, John K. 1980. The Audubon Society Encyclopedia of North American Birds. Alfred A. Knopf, New York. USDA Forest Service. 1979. Effects of Fire on Soil, A State of Knowledge Review. USFS, GTR. WO-7.

USDA Forest Service. 1986. Land and Resource Management Plan. Toiyabe National Forest, NV-CA. Chap. IV-pp 81.

USDA Forest Service. 1991. Threatened, Endangered, and Sensitive Species of the Intermountain Region, Ogden, UT: U.S. Department of Agriculture, Forest Service.

USDA Forest Service 2000. Survey protocol for northern goshawk (*Accipiter gentilis*) on national forest lands in the Pacific Soutwest Region. Forest Service, Region 5, San Francisco, CA.

USDA Forest Service. 2001 Sierra Nevada Forest Plan Amendment, Final Environmental Impact Statement (FEIS). Pacific Southwest Region, Vallejo, CA.

USDA Forest Service. 2001 and 2004a. Sierra Nevada Forest Plan Amendment, Record of Decision (ROD). Pacific Southwest Region, Vallejo, CA.

USDA Forest Service. 2005. Wildland fire in ecosystems – effects of fire on soil and water. Rocky Mountain Research Station GTR-42

USDA Forest Service. 2006. Assessment of Wilderness Potential: An Assessment of Lands on the Humboldt-Toiyabe National Forest that have Potential for Consideration by Congress for Wilderness Designation. Humboldt-Toiyabe National Forest, http://www.fs.fed.us/r4/htnf/projects/forestplan/revision_docs.shtml

USDA Forest Service. 2008a. Challenging cheatgrass: can tools like the “black fingers of death” fight this formidable invasive species? RMRS

USDA Forest Service. 2009. Biological Evaluation for Threatened, Endangered and Sensitive Plants and Fungi for the Spooner Hazardous Fuels Reduction and Healthy Forest Restoration Project, Douglas, Washoe, and Carson City Counties of Nevada. Prepared by Wendy Boes, Botanist for the Adaptive Management Services Enterprise Team, on file at the Carson Ranger District. 35pgs.

USDI Fish and Wildlife Service (USFWS). 2001. 50 CFR Part 17. Endangered and threatened wildlife and plants; 12-month finding for a petition to list the plant *Botrychium lineare* (slender moonwort) as threatened. Federal Register 66: 30368-30372.

Wasley, T. 2004. Nevada’s Mule Deer: Population and Dynamics-Issues and Influences. Nevada Department of Wildlife. Reno Nevada. PP10-11.

Witham, C. W. 2000. Current knowledge and conservation status of *Ivesia webberi* Gray (Roasaceae), the webber ivesia, in Nevada. Carson City: Nevada natural heritage program status report prepared by the U.S. Fish and Wildlife Service,. Reno, NV.

Young J. A., and C. D. Clements. Cheatgrass, Fire and Forage on the Range. University of Nevada Press, Reno and Las Vegas, 2009, 348 p.

Ypsilantis, W.G. 2003. Resource notes – risk of cheatgrass invasion after fire in selected sagebrush community types. National Science and Technology Center. 4 p.

Zielinski, W.J., and W.D. Spencer, and R.H. Barrett. 1983. Relationship between food habits and activity patterns of pine martens. Journal of Mammology, 64(3) 387-396.

Zeiner, D. C., W., F. Laudenslayer, Jr., K. E. Mayer, M. White. Editors. 1990. California's Wildlife. Volume 2. Birds. State of California, Department of Fish and Game. Sacramento, California. 731 pp.

Appendix A Species Associated With Habitat Types In The Project Area					
Species-Common Name	**Riparian /Aspen**	**Mixed conifer/ late successional Forest**	**Montane Chaparral**	**BBS Trend**	**Present during 2008, 2009, 2010 survey**
Belted kingfisher	X			slightly declining	NO
Mountain quail	X		X	stable	NO
Common poorwill			X	stable	NO
Calliope hummingbird			X	stable	YES (1)
Gray flycatcher			X	increasing	NO
Sage Thrasher				stable	NO
Green-tailed towhee			X	stable	YES (1)
Brewer's sparrow			X	significantly declining	NO
Black-chinned sparrow			X	stable	NO
Red-breasted sapsucker	X	X		slightly increasing	YES (6)
Tree swallow	X			increasing significantly	NO
Northern rough-winged swallow	X			slightly increasing	NO
House wren	X			slightly decreasing	YES (4)

Appendix A Species Associated With Habitat Types In The Project Area					
Species-Common Name	**Riparian /Aspen**	**Mixed conifer/ late successional Forest**	**Montane Chaparral**	**BBS Trend**	**Present during 2008, 2009, 2010 survey**
Swainson's thrush	X	X		stable	NO
American robin	X	X		decreasing significantly	YES (52)
Yellow warbler	X			decreasing significantly	NO
Orange-crowned warbler	X			slightly decreasing	NO
Nashville warbler		X		decreasing significantly	YES (2)
Wilson's warbler	X			decreasing significantly	NO
Virginia warbler			X		NO
Yellow-rumped warbler		X		stable	YES (4)
Chipping sparrow		X		decreasing significantly	YES (7)
Song sparrow	X			slightly increasing	YES(2)
Lincoln's sparrow	X		X	slightly decreasing	NO
White-crowned sparrow				slightly decreasing	NO
Lazuli bunting	X			slightly increasing	NO
Bank swallow	X			no information	NO

Appendix A Species Associated With Habitat Types In The Project Area					
Species-Common Name	**Riparian /Aspen**	**Mixed conifer/ late successional Forest**	**Montane Chaparral**	**BBS Trend**	**Present during 2008, 2009, 2010 survey**
Black-headed grosbeak	X			slightly decreasing	YES (7)
Common yellowthroat	X			no information	NO
Swainson's hawk	X			no information	NO
Tricolored blackbird	X			no information	NO
Warbling vireo	X			stable	YES (28)
Yellow breasted chat	X			stable	NO
White-headed woodpecker		X		stable	NO
Pileated woodpecker		X		stable	NO
Hairy woodpecker	X	X		stable	YES (2)
Williamson's sapsucker	X	X		stable	NO
Red-breasted nuthatch		X		stable	YES(4)
Pygmy nuthatch		X		stable	YES (2)
Brown creeper		X		stable	YES(12)
Winter wren	X	X		stable	NO

Appendix A Species Associated With Habitat Types In The Project Area					
Species-Common Name	**Riparian /Aspen**	**Mixed conifer/ late successional Forest**	**Montane Chaparral**	**BBS Trend**	**Present during 2008, 2009, 2010 survey**
Hermit warbler		X		stable	NO
Purple finch		X		decreasing significantly	NO
Cassin's finch		X		decreasing significantly	YES(3)
Evening grosbeak		X		stable	NO